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Limited Field Investigation Report for the 100-BC-1 Operable Unit

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EXECUTIVE SUMMARY

BACKGROUND

This limited field investigation (LFI) report summarizes the data collection and analysis activities conducted during the 100-BC-1 Source Operable Unit LFI and the associated qualitative risk assessment (QRA), and makes recommendations on the continued candidacy of high-priority sites for interim remedial measures (IRM). The results and recommendations presented in this report are generally independent of future land use scenarios. This report is unique in that it is based on Hanford-specific agreements discussed in the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1990), the *Hanford Site Baseline Risk Assessment Methodology* (HSBRAM) (DOE-RL 1993a), the *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-1 Operable Unit* (DOE-RL 1992a), and the *Hanford Past-Practice Strategy* (HPPS) (DOE-RL 1991), and must be viewed in this context. The HPPS, described and justified in *The Hanford Federal Facility Agreement and Consent Order Change Package*, dated May 16, 1991 (Ecology et al. 1991), emphasizes initiating and completing waste site cleanup through interim actions.

A LFI Report is required, in accordance with the HPPS, when waste sites are to be considered for IRMs. The purpose of the report is to identify those sites that are recommended to remain as candidates for IRMs, provide a preliminary summary of site characterization studies, refine the conceptual model as needed, identify contaminant- and location-specific applicable or relevant and appropriate requirements (ARARs), and provide a qualitative assessment of the risks associated with the sites. This assessment includes consideration of whether contaminant concentrations pose an unacceptable risk that warrants action through IRMs. An IRM is defined by the HPPS in broad terms and is not restricted to limited- or near-term actions. Interim remedial measures are intended to achieve remedies that are likely to lead to a final Record of Decision (ROD). The final decision to conduct an IRM will rely on many factors including risk, ARARs, future land use, point of compliance, time of compliance, a bias-for-action, and the threat to human health and the environment.

The unit managers assigned all known and suspected areas of contamination in the 100-BC-1 Operable Unit either a high- or low-priority, as listed in Table ES-1. The classification of sites was based on the collective knowledge of the three parties and information contained in existing work plans. The site classification decisions were made during joint meetings with the three parties and are documented by meeting minutes that are part of the administrative record. Sites classified as high-priority pose risk(s) through one or more pathways sufficient to recommend a streamlined action via an IRM. Low-priority sites do not pose risks sufficient to recommend streamlining.

The 100-BC-1 Operable Unit is one of three operable units associated with the 100 B/C Area at the Hanford Site. The 100-BC-1 and 100-BC-2 operable units address contaminant sources while the 100-BC-5 Operable Unit addresses contamination present in the underlying groundwater. The 100-BC-1 Operable Unit encompasses approximately

1.8 km^2 (0.7 mi^2) and is located immediately adjacent to the Columbia River shoreline. In general, it contains waste units associated with the original plant facilities constructed to support B Reactor operation, as well as the cooling water retention basin systems for both B and C Reactors. Currently, the only active facilities in the 100-BC-1 Operable Unit are those that extract and treat water from the Columbia River and transport that water to other 100 Area and 200 Area facilities.

The 100-BC-1 LFI began the investigative phase of the remedial investigation for a select number of high-priority sites. The LFI was performed to provide additional data needed to support selection, design and implementation of IRMs, if needed. The LFI included data compilation, non-intrusive investigations, intrusive investigations at five high-priority sites, summarization of 100 Area aggregate studies, and data evaluation.

INVESTIGATION RESULTS

Three methods of intrusive investigation were used in the LFI: boreholes were drilled, test pits were excavated, and surface soils were sampled. The samples submitted for laboratory analysis. Boreholes were surveyed for radiological contamination using downhole geophysical techniques to further delineate the locations and levels of contaminants. Materials removed from the boreholes and test pits were screened in the field for volatile organic compounds and radionuclides to assist in selection of sample intervals. Analytical data were validated. All data associated with the LFI were evaluated.

Five sites were intrusively investigated: 116-B-1, 116-B-2, 116-B-3, 116-B-5, and 116-C-5. Boreholes were drilled and sediments sampled at 116-B-1, 116-B-2, 116-B-3, and 116-B-5. Test pits were excavated and sediments and sludge sampled at 116-C-5. Vadose zone sediments from 100-BC-5 monitoring well boreholes near sites 116-B-2, 116-B-13, 116-C-1, and south of 116-C-5 were also sampled and analyzed.

Radiological contamination is the primary concern as confirmed through this study. The principal radionuclides are ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, $^{239/240}Pu$, and ^{241}Am. The highest concentrations of radionuclides were found in 116-C-5 retention basin sludge samples. Metals contamination was found principally and in the highest concentrations at the 116-C-5 retention basin. The maximum concentrations of metals in 116-C-5 samples were: Cr - 609 mg/kg, Pb - 564 mg/kg, Cu - 46.8 mg/kg, Hg - 4.3 mg/kg, and Zn - 309 mg/kg. Concentrations of Cr exceed a potential soil ARAR, Model Toxics Control Act (MTCA) Method B concentrations. Semi-volatile organic compounds were detected in low concentrations, i.e., below the contract required quantitation limits. Volatile organic compounds, while detected, were generally low in concentration or likely are laboratory artifacts. Contaminant concentrations and locations determined through the intrusive investigation generally confirm historical information such as documented in Dorian and Richards (1978). The remaining high-priority sites in the 100-BC-1 Operable Unit were evaluated using data from analogous facilities in the 100 Areas. No 100-BC-1 sites showed contamination that would warrant an expedited response action (ERA).

QUALITATIVE RISK ASSESSMENT

A QRA was performed for the high-priority sites. Conservative assumptions such as highest reported contaminant levels from either the LFI or historical data base were utilized. The QRA provides estimates of human health risks assuming either low-frequency or high-frequency use and includes considerations such as the attenuation of external dose provided by layers of clean gravel fill that overlie many sites. The QRA identifies the major human health risk to be external exposure from the radionuclides ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{154}Eu. The QRA also provides environmental hazard quotient (EHQ) risk estimates for many of the 100-BC-1 high-priority sites.

IRM RECOMMENDATIONS

The 100-BC-1 high-priority sites were evaluated using the following criteria to identify sites recommended to continue as an IRM candidates; a detailed discussion of the criteria is provided in Section 5.2 of this report:

- The QRA provides risk estimates for human health and the EHQ ratings. Sites with high or medium risks to human health for the low-frequency use scenario or are recommended to continue as IRM candidates. High risk corresponds to an incremental cancer risk (ICR) $>$1E-02. Medium risk corresponds to an ICR between 1E-04 and 1E-02. Low risk corresponds to an ICR between 1E-06 and 1E-04. Very low risk corresponds to an ICR of $<$1E-06. Sites with an EHQ rating >1 are also recommended to continue as IRM candidates.

- If contaminants at the waste site exceed a chemical-specific ARAR, that site is recommended to continue as an IRM candidate. The Washington State MTCA Method B concentrations are potential ARARs for soil contamination, as discussed in Section 3-25 of this report and in the *100 Area Feasibility Study, Phases 1 and 2* (DOE-RL 1992e). Model Toxics Control Act Method B regulatory limits for soil contaminant concentrations are utilized because they are the standard method and are conservative.

- If LFI results indicate that a site is a current source of groundwater contamination then the site is recommended to continue as an IRM candidate.

- The conceptual model for the waste site includes sources of contamination, types of contaminants, affected media, known and potential routes of migration, known or potential human and environmental receptors, and the general understanding of the site structure/process. If the conceptual model of the site is found to be incomplete, collection of data needed to complete the model through limited field sampling is recommended. Sites with incomplete conceptual models are recommended to continue as IRM candidates.

- The potential for the contaminants at a site to be reduced by natural attenuation, e.g., radioactive decay by the year 2018, may be a consideration for sites where the excess risk is caused by external exposure from radionuclides with half lives of less than 30 years. This is not a consideration for sites where multiple exposure pathways drive the risk.

Table ES-2 presents the evaluation of the high-priority waste sites using the above criteria, and the site-specific IRM candidate recommendations. The following sites are recommended to continue as IRM candidates:

- 116-B-1, 116-B-5, 116-B-11, 116-C-5, 116-C-1, 116-B-7, 132-B-6, 132-C-2, Process Effluent Pipelines, 116-B-13 and 116-B-14, 116-B-4, and 116-B-12.

Burial grounds, i.e., sites 118-B-5, 118-B-7, and 118-B-10, are recommended as IRM candidates, as per the HPPS and negotiations with the Tri-Parties.

The 116-B-9 and 116-B-10 sites are recommended to continue as IRM candidates while data are collected to complete their conceptual models. Additional limited sampling is recommended at these sites. Once the conceptual models are completed the sites should be reevaluated to consider their continued candidacy for IRMs.

The 116-B-2, 116-B-3, 116-B-6A, 116-B-6B, 128-B-3, and 126-B-2 sites are not recommended to continue as IRM candidates because human and ecological risks are low, soil contamination does not exceed ARARs, there is no impact to groundwater, and natural attenuation will further reduce site risks. Action at these sites may be deferred until final remedy selection.

Table ES-1 100-BC-1 Operable Unit High-Priority Sites and Low-Priority Facilities

High-Priority Sites	Low-Priority Sites
116-B-1 Trench*	1607-B1 Septic system
116-C-1 Trench+	1607-B2 Septic system
116-B-11 Retention basin+	1607-B3 Septic system
116-C-5 Retention basin*	1607-B4 Septic system
116-B-2 B-reactor fuel storage basin trench*	1607-B5 Septic system
116-B-3 Pluto crib*	1607-B6 Septic system
116-B-5 Maintenance shop and decon pad crib*	1607-B7 Septic system
116-B-7 Process effluent outfall+	1716-B Gas station/garage area
132-B-6 Process effluent outfall+	Underground chemical tanks
132-C-2 Process effluent outfall+	Coal ash storage yard
Process pipe (sludge)+	Electrical facilities
Process pipe (soil)+	120-B-1 Battery acid sump
116-B-13/14 Retention basin sludge trenches+	126-B-1 Ash pit
118-B-5 Ball 3x burial ground	126-B-3 Coal pit demolition and inert waste
116-B-6B Crib+	128-B-1 Burning pit
116-B-4 Dummy decontamination french drain+	128-B-2 Sand blast disposal site
116-B-9 French drain	183-B Filter plant
116-B-10 Dry well	118-B-9 Storage building
116-B-12 Crib+	
118-B-7 Solid waste burial site	
132-B-4/5 Demolished facility	
116-B-6A Crib+	
118-B-10 Solid waste burial ground	
128-B-3 Burn Pit	
126-B-2 Clearwells	

* = Additional sampling conducted as part of a limited field investigation
+ = Additional data from an analogous facility
• = Selected sites in 100-BC-1 and 100-BC-2 sampled for contamination by polychlorinated biphenyl

Table ES-2 IRM Recommendations for 100-BC-1 High-Priority Sites

Waste Site	Qualitative Risk Assessment		Conceptual Model	Exceeds ARAR	Probable Current Impact on Groundwater	Potential for Natural Attenuation by 2018	IRM Candidate yes/no
	Low-frequency scenario	EHQ > 1					
116-B-1	low	no	adequate	no	yes	yes	yes
116-B-2	low	no	adequate	no	no	yes	no
116-B-3	low	no	adequate	no	no	yes	no
116-B-5	low	yes	adequate	no	no	yes	yes
116-C-5	medium	yes	adequate	yes	yes	no	yes
116-C-1	medium	no	adequate	yes	yes	yes	yes
116-B-11	high	yes	adequate	yes	yes	no	yes
116-B-7, 132-B-6, and 132-C-2	medium	-	adequate	no	no	no	yes
Process Pipe (sludge)	high	yes	adequate	yes	yes	no	yes
Process Pipe (soil)	low	no	adequate	no	yes	no	yes
116-B-13/14	medium	yes	adequate	yes	yes	no	yes
116-B-6A	low	-	adequate	no	no	no	no
116-B-6B	very low	no	adequate	no	no	no	no
116-B-4	medium	-	adequate	no	no	yes	yes
116-B-9	low	-	incomplete*	unknown*	no	unknown*	yes*
116-B-10	high	-	incomplete*	unknown*	no	unknown*	yes*
116-B-12	medium	-	adequate	no	yes	no	yes
132-B-4 and 132-B-5	very low	yes	adequate	no	yes	no	yes
128-B-3	low	-	adequate	no	no	no	no
126-B-2	low	-	adequate	no	no	no	no
118-B-5, 118-B-7, and 118-B-10 Burial grounds							yes

EHQ = Environmental Hazard Quotient calculated by the qualitative ecological risk assessment
- = Not rated by the qualitative ecological risk assessment
* = Data needed concerning nature and vertical extent of contamination, site remains an IRM candidate until data are available.
ARAR = Applicable or Relevant and Appropriate Requirement, specifically the Washington state Model Toxics Control Act Method B concentration values for soils
IRM = interim remedial measures

ACRONYMS

ARAR	applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Contract Laboratory Program
CMS	corrective measures study
CRDL	contract required detection limit
CRQL	contract required quantitation limit
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EHQ	environmental hazard quotient
EII	Environmental Investigation Instruction
EPA	U.S. Environmental Protection Agency
ERA	expedited response action
FS	feasibility study
GPR	ground penetrating radar
HCRL	Hanford Cultural Resources Laboratory
HEIS	Hanford Environmental Information System
HPGe	high purity germanium
HPT	Health Physics Technician
HQ	hazard quotient
HSBRAM	Hanford Site Baseline Risk Assessment Methodology
HPPS	Hanford Past-Practice Strategy
ICR	incremental cancer risk
IRM	interim remedial measure
LFI	limited field investigation
LOEL	lowest observable effect level
MTCA	Model Toxics Control Act
NHPA	National Historic Preservation Act
NOEL	no observable effects level
OVM	organic vapor monitor
PCB	polychlorinated biphenyl
PID	photoionization detector
PNL	Pacific Northwest Laboratories
QC	quality control
QRA	qualitative risk assessment
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RI	remedial investigation
RLS	radiation logging system
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
semi-vol	semi-volatile organic compound
sG	specific gravity
SSO	Site Safety Officer

ACRONYMS (cont)

TAL	target analyte list
TBC	to-be-considered
TCE	trichloroethylene
TCL	target compound list
UTL	Upper Threshold Limit
VOC	volatile organic compound
WHC	Westinghouse Hanford Company
XRF	x-ray fluorescence

CHEMICAL ABBREVIATIONS

As	arsenic
Ba	barium
Cd	cadmium
Cr	chromium
Cu	copper
Fe	iron
Hg	mercury
Mg	magnesium
Mn	manganese
Na	sodium
Ni	nickel
Pb	lead
Si	silicon
Th	thorium
V	vanadium
Zn	zinc
Zr	zirconium
^{3}H	tritium
^{7}Be	beryllium-7
^{14}C	carbon-14
^{22}Na	sodium-22
^{40}K	potassium
^{54}Mn	manganese-54
^{58}Co	cobalt-58
^{59}Fe	iron-59
^{60}Co	cobalt-60
^{63}Ni	nickel-63
^{65}Zn	zinc-65
^{90}Sr	strontium-90
^{99}Tc	technetium-99
^{99}Zr	zirconium-99
^{103}Ru	ruthenium-103
^{106}Ru	ruthenium-106
^{134}Cs	cesium-134
^{137}Cs	cesium-137
^{140}Ba	barium-140
^{141}Ce	cesium-141
^{144}Ce	cesium-144
^{152}Eu	europium-152
^{154}Eu	europium-154
^{155}Eu	europium-155
^{226}Ra	radium-226
^{228}Th	thorium-238
^{235}U	uranium-235

CHEMICAL ABBREVIATIONS (cont)

^{238}Pu	plutonium-238
^{238}U	uranium-238
$^{239/240}Pu$	plutonium-239/240
^{241}Am	americium-241

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1.0 INTRODUCTION

This limited field investigation (LFI) Report summarizes the data collection and analysis activities conducted during the 100-BC-1 Source Operable Unit LFI and the *Qualitative Risk Assessment of the 100-BC-1 Source Operable Unit*, (WHC 1993a). A LFI report is required, in terms of the *Hanford Past-Practice Strategy* (HPPS) (DOE-RL 1991), when waste sites are to be considered for interim action as interim remedial measures (IRM). The purpose of the report is to identify those sites that are recommended to remain as candidates for IRMs, provide a preliminary summary of site characterization studies, to refine conceptual model as needed, identify contaminant- and location-specific applicable or relevant and appropriate requirements (ARARs), and provide a qualitative assessment of the risks associated with the sites. This assessment includes consideration of whether contaminant concentrations pose an unacceptable risk that warrants action through interim remedial measures. These objectives are described fully in the *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-1 Operable Unit* (DOE-RL 1992a).

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The work plan (DOE-RL 1992a) divides the site characterization activities into 12 tasks. These are subjects of the LFI summary of characterization studies. Table 1-1 lists the 12 characterization tasks and how each is addressed in the LFI report.

In order to limit the size of the report and improve its readability, reliance is placed on the referral to other documents for specific details. This document is unique in that it is based on Hanford-specific agreements discussed in the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1990), the HPPS, the *Hanford Site Baseline Risk Assessment Methodology* (HSBRAM) (DOE-RL 1993a), and the *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-1 Operable Unit* (DOE-RL 1992a) and must be viewed in this context. An IRM, for example is defined in broad terms and is not restricted to limited or near term actions. It allows for interim action with the final goal of achieving final action levels. Indeed, an IRM may not be decided upon, if it is likely not to lead to a final Record of Decision (ROD). A qualitative risk assessment (QRA) is used only to assess risk for an IRM determination and is not intended to define current risk or baseline risk in a traditional sense. The final decision to conduct an IRM will rely on many factors including the QRA, ARARs, future land use, point of compliance, time of compliance, a bias-for-action, and the threat to human health and the environment including the threat to groundwater.

1.1 SITE BACKGROUND

The 100-BC-1 Operable Unit is one of three operable units associated with the 100 B/C Area at the Hanford Site. The 100-BC-1 Operable Unit and 100-BC-2 Operable Unit are source operable units, which are composed of waste sites. The 100-BC-1 waste sites are those liquid and sludge disposal sites generally associated with operation of the B Reactor. The third operable unit, 100-BC-5, is the groundwater operable unit.

The geographical area associated with the 100-BC-1 Operable Unit is located immediately adjacent to the Columbia River shoreline. In general, it contains waste units associated with the original plant facilities constructed to support B Reactor operation, as well as the cooling water retention basin systems for both B and C Reactors. Figure 1-1 shows the approximate boundaries of the 100-BC-1 Operable Unit as defined by the waste units it includes, and its location with respect to the other operable units. The 100-BC-1 Operable Unit encompasses approximately 1.8 km^2 (0.7 mi^2). It lies predominantly within Section 11, the southern portion of Section 2, and the western portion of Section 12 of Township 13N, Range 25E. It is bound by North American Datum 1983 (NAD 83) metric Washington State plane north/south coordinates N144300 and N145650 and east/west coordinates E564500 and E566680.

The 100 B/C Area contains two reactors: the B Reactor associated with the 100-BC-1 Source Operable Unit and the C Reactor associated with the 100-BC-2 Source Operable Unit. The B Reactor, constructed in 1943, operated from 1944 through 1968, when it was retired from service. The C Reactor, constructed in 1951, operated from 1952 until 1969, when it also was retired from service. The C Reactor shared some of the ancillary facilities constructed for the B Reactor, such as the river water pump house and reservoir and the inert gas system.

Currently, the only active facilities within the boundaries of the 100-BC-1 Operable Unit are the 181-B river pump house, located in the northwest corner of 100-BC-1, the 182-B water reservoir and pump house, and part of the water transport system. River water is delivered by pipeline to the 200 Area to the south and to some of the other 100 Area facilities. The water is referred to as "export" water.

The 100-BC-5 Groundwater Operable Unit is described in the *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit* (DOE-RL 1992b). The results of a recently completed LFI for the 100-BC-5 Operable Unit are presented in the *Limited Field Investigation Report for the 100-BC-5 Operable Unit*, (DOE-RL 1993b). The following summary of groundwater information is from that LFI. Groundwater in the 100 B/C Area flows in a northerly direction towards the Columbia River. The depth to groundwater at high river stage ranges from 22.89 m (75.1 ft) in well 199-B4-4, located near the B Reactor, to 15.06 m (49.41 ft) in well 199-B3-47, located due north of the 116-B-14 sludge disposal trench. The estimated hydraulic conductivities in the uppermost aquifer range from 2×10^{-2} cm/s (50 ft/d) to 5×10^{-3} cm/s (15 ft/d). The 100-BC-5 QRA (WHC 1993b) human health risk assessment identified bis(2-ethylhexyl) phthalate, ^{14}C, ^{90}Sr, ^{99}Tc, and ^{3}H as contaminants of concern. The environmental risk assessment for aquatic toxicity for fish from non-radioactive contaminants indicated that aluminum, Cr (hexavalent), Fe, Pb, Hg, and bis(2-ethylhexyl) phthalate exceeded either an acute or chronic toxicity value. Because groundwater contamination in the 100-BC-5 Operable Unit may impact the Columbia River, the potential impact of 100-BC-1 Source Operable Unit waste sites on groundwater is an important consideration when recommending IRMs.

1.2 THE HANFORD PAST-PRACTICE STRATEGY AND THE 100-BC-1 LFI

The signatories to the Tri-Party Agreement (Ecology et al. 1990), i.e., the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology), recognized the need for a new strategy of Resource Conservation Recovery Act/Comprehensive Environmental Response Compensation and Liability Act (RCRA/CERCLA) integration to provide greater uniformity in the applicability of requirements to the Hanford Site. Additionally, the signatories agreed that proceeding with the traditional CERCLA approach would likely require too much time and too large a portion of a limited budget be spent before actual cleanup would occur. Another motivation for a new strategy was the need to coordinate past-practice investigations with RCRA closure activities since some operable units contain RCRA treatment storage and disposal facilities. This new strategy, the HPPS, is described and justified in *The Hanford Federal Facility Agreement and Consent Order Change Package* (Ecology et al. 1991).

In response to the above concerns, the three parties have decided to manage and implement all past-practice investigations under one characterization and remediation strategy. In order to enhance the efficiency of ongoing remedial investigation /feasibility study (RI/FS) and RCRA facility investigation/corrective measures study (RFI/CMS) activities at the 100 Area of the Hanford Site, and to expedite the ultimate goal of cleanup, more emphasis will be placed on initiating and completing waste site cleanup through interim actions.

This strategy streamlines the past-practice remedial action process and provides new concepts for:

- Accelerating decision-making by maximizing the use of existing data consistent with data quality objectives.

- Undertaking expedited response actions (ERA) and/or IRMs, as appropriate, to either remove threats to human health and welfare and the environment, or to reduce risk by reducing toxicity, mobility, or volume of contaminants.

The HPPS describes the concepts and framework for the RI/FS process in a manner that has a bias-for-action through optimizing the use of interim actions, culminating with decisions on final remedies on both an operable unit and 100 Area aggregate scale. The strategy focuses on reaching early decisions to initiate and complete cleanup projects, maximizing the use of existing data, coupled with focused short-time-frame investigations, where necessary. As more data become available on contamination problems and associated risks, the details of the longer term investigations and studies will be better defined.

Figure 1-2 is a decision flow chart that shows the HPPS process. The strategy includes three paths for interim decision-making and a final remedy-selection process for the operable unit that incorporates the three paths and integrates sites not addressed in those paths. An important element of this strategy is the application of the observational approach, in which characterization data are collected concurrently with cleanup.

As shown on Figure 1-2, the three paths for interim decision-making are:

- An ERA path, where an existing or near-term unacceptable health or environmental risk from a site is determined or suspected, and a rapid response is necessary to mitigate the problem.

- An IRM path, where existing data are sufficient to formulate a conceptual model and perform a QRA. If a decision is made to proceed with an IRM, the process will advance to select an IRM remedy, and may include a focused FS, if needed, to select a remedy.

- A LFI path, where a LFI can provide sufficient data to formulate a conceptual model and perform a QRA. The data can be obtained in a less formal manner than that needed to support the operable unit ROD; however, regardless of the scope of the LFI, it is a part of the RI process, and not a substitute for it.

The near-term past-practice strategy for the 100 Area provides for ERAs, IRMs, and LFIs for individual waste sites, grouped waste sites, and contaminated groundwater. The LFI is an integral part of the RI/FS process and functions as a focused RI for selection of IRMs. The information obtained from the LFIs and interim actions may be sufficient to perform the baseline risk assessment, and to select the remedy for the operable unit. If the data are not sufficient, additional investigations and studies will be performed to the extent necessary to support the operable unit remedy selection. These investigations would be performed within the framework and process defined for RI/FS programs.

Implementation of the HPPS at the 100-BC-1 Operable Unit began with the development of Revision 0 of the *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-1 Operable Unit* (DOE-RL 1992a). As noted in Section 4.2.1 of the work plan the three parties assigned all known and suspected areas of contamination either a high- or low-priority, as listed in Table 1-2. The classification of sites was based on the collective knowledge of the three parties and information contained in existing work plans. The site classification decisions were made during joint meetings with the three parties and are documented by meeting minutes that are part of the administrative record. Sites classified as high-priority were thought to pose a risk(s) through one or more pathways sufficient to recommend streamlined action via an IRM. Low-priority sites were thought not to pose risks sufficient to recommend streamlining. The three parties agreed that:

- None of the high-priority sites pose risks that would require an ERA.

- Limited field sampling was sufficient for those high-priority sites where data are deemed insufficient to formulate the conceptual model and support the QRA.

- Investigative activities for the low-priority sites would be deferred to the final RI.

- Certain activities would be more efficient to implement at the 100 Area aggregate or Hanford Site scale instead of the operable unit scale.

The LFI and QRA are part of the 100-BC-1 RI/FS, as described by the work plan (DOE-RL 1992a). The work plan includes the following topics that are directly applicable to the 100-BC-1 LFI:

- operable unit site description (Section 2.1)
- physical setting (Section 2.2)
- operable unit conceptual model (Chapter 3)
- data quality objectives (Section 4.1.1)
- data needs (Section 4.1.2)
- 100-BC-1 Operable Unit sampling and analysis approach (Section 4.2.2)
- limited field investigations (Section 5.1.1)
- 100 Area aggregate studies and Hanford Site studies (Section 5.1.1).

The conceptual model for the 100-BC-1 Operable Unit was developed during the RI scoping process. The conceptual model is presented in Chapter 3 of the work plan (Section 4.1.1) (DOE-RL 1992a). The conceptual model addresses the following:

- structure and process of the waste sites
- source of contaminants
- type of contaminants
- nature and extent of contamination
- known and potential routes of migration
- known and potential human and environmental receptors.

This conceptual model has been updated with data acquired through the LFI, and is presented in Chapter 5 of this report.

The 100-BC-1 LFI began the investigative phase of the RI for a select number of high-priority sites. The LFI included data compilation, non-intrusive investigations, intrusive investigations, evaluation of information from 100 Area aggregate studies, and data evaluation.

1.3 HISTORICAL DATA

An integral part of the RI/FS process for the 100-BC-1 Operable Unit has been the acquisition, evaluation, and utilization of records pertaining to the construction, operation, and decontamination/decommissioning of the reactor and related 100 B/C facilities. This information is categorized as "historical information," and includes operations records and reports, engineering drawings, photographs, interviews with former or retired operations personnel, and data from sampling and analysis of facilities and the local environment.

A primary reference for radiological characterization of the 100-BC-1 Operable Unit sources is a sampling study of the 100 Area performed during 1975/76 by Dorian and

Richards (1978). In the 100-BC-1 Operable Unit area Dorian and Richards (1978) collected samples from the retention basins, effluent pipelines and surrounding soil, retention basin sludge disposal trenches, liquid waste disposal trenches, and the miscellaneous trenches, cribs, and french drains located near the B Reactor. Samples of soil were collected from the surface and from the subsurface, to a maximum of 38 ft below grade. Samples were also collected from retention basin sludge and concrete and from effluent line scale and sludge. The samples were analyzed for radionuclides. Inventories of radionuclides for the facilities and sites were calculated. Results from Dorian and Richards (1978) were a major resource used in the development of the 100-BC-1 conceptual model and LFI data needs. It should be noted, however, that only concentrations and inventories of selected radionuclides were reported in the 1975/76 study. In particular, ^{63}Ni, which is generally present at activities on the same order of magnitude as ^{60}Co, was reported for only some samples; ^{99}Tc, detected in 100 B/C Area groundwater wells, was not evaluated; and daughter product radionuclides of ^{90}Sr and ^{137}Cs, which have approximately the same activities as the parent nuclides, were not included in summaries of total activity.

1.4 100 AREA AGGREGATE STUDIES

The 100 Area aggregate studies and Hanford Site studies provides integrated analyses of selected issues on a scale larger than the operable unit, such as the Hanford Site background study. The 100-BC-5 Work Plan (DOE-RL 1992b) addresses activities common to the 100 Area such as a river impact study, a shoreline study, an ecological study, and a cultural resource study. These studies provide data to be used in the LFI. Final remedy selection will be based on the procedures and policies in place at the time of the selection. Results of the Hanford Site background study, the 100 Area ecological study, and cultural resource study that are applicable to the 100-BC-1 LFI are summarized below.

1.4.1 Hanford Site Background

Results of the characterization of the natural chemical composition of Hanford Site soil samples is presented in *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analyses* (DOE-RL 1993c). This characterization is based on the chemical analysis of inorganic constituents from more than 200 samples. The characterization included an analysis of physical properties and factors that might affect the natural soil chemical composition, as determined by regulatory protocols. Hanford Site soils have not been characterized sufficiently to establish the natural concentrations of the following types of constituents: volatile organic compounds (VOC), semi-volatile organic compounds (semi-vols), pesticides and polychlorinated biphenyls (PCB), and radionuclides.

Table 1-3 presents the lognormal distribution 95th percentile of the data for a lognormal distribution and the 95% confidence limit of the 95th percentile of the data distribution for inorganic analyses of Hanford Site soils (DOE-RL 1993c). The 95% confidence limit of the 95th percentile of the data distribution, abbreviated as the 95% upper threshold limit (UTL) is one way to define threshold levels. The 95% UTL values for inorganic constituents have been utilized in the 100-BC-1 QRA (WHC 1993a) to establish site potential contaminants of concern. An inorganic constituent at a site is considered a contaminant if the reported concentration exceeds the 95% UTL values. Because sitewide background levels for organic and radionuclide constituents have not been established (DOE-RL 1993c) all detected concentrations of these constituents were considered in the QRA as potential contaminants of concern.

1.4.2 Ecological Analysis

The 100 Area operable units, which cover a total area of 1834 ha (18.3 km^2) are topographically and environmentally similar. Each is situated along the Columbia River bank, with the reactor located on a high gravel terrace left by the recession of glacial floodwaters at the end of the Pleistocene. Shoreline areas grade from steep banks with narrow cobble beaches to broad, stepped, well-defined floodplain terraces with gently sloping beaches. The floodplain terraces consist of sand deposited during the Holocene and occur on at least two levels, one dating to the early or middle Holocene and another representing the later Holocene. Inland areas are broad flats broken only by stabilized dunes. The area from west of the 100 N Area to the western edge of the 100 D Area differs from this general pattern. The large, rounded gravel mounds in that vicinity are chaotic ripple marks produced by the rush of catastrophic Pleistocene floodwaters.

Vegetation in the 100 Areas is dominated by cheatgrass (*Bromus tectorum*), with scattered big sagebrush (*Artemisia tridentata*), tumble mustard (*Sysimbrium spp.*), Russian thistle (*Salsola kali*), rabbit brush (*Chrysothamnus spp.*), and needle and thread grass (*Stipa comata*). Small groves of deciduous trees and shrubs, usually black locust (*Robina pseudo-acacia*), willow (*Salix spp.*), and mulberry (*Morus spp.*) grow along the river bank at the site of early twentieth-century homesteads.

Ecological surveys and sampling related to CERCLA have been conducted in the 100 Areas and in and along the Columbia River adjacent to the 100 Areas. Sampling included plants with either a past history of documented contaminant uptake or an important position in the food web, such as river algae, reed canary grass, tree leaves, and asparagus. In addition, samples were collected of caddisfly larvae (next step in the food chain from algae), burrow soil excavated by mammals and ants at waste sites, and pellets cast by raptors and coyote scat, to determine possible contamination of the upper end of the food chain. The results of these sample analyses are being compiled and will be presented in separate documents. Other sampling results generated by site-wide surveillance and facility monitoring programs will also be used in the evaluation of ecological contamination. The ecological samples that have been evaluated at this time show no noticeable contamination within the 100 B/C Reactor area, but do indicate contamination in samples from between the 100 B/C and 100 K Areas, downriver from the 100 K Area, and in the 100 N Area. Initial samples from trees near the 100 K Area contained 35 and 6.5 pCi/g ^{90}Sr. While this level of contamination is not of high concern, additional samples were taken from the same area to verify the relative range of these levels. This second round of sampling (12 samples) showed up to 88 pCi/g ^{90}Sr.

In addition, bird, mammal, and plant surveys were conducted and reported in Sackschewsky and Landeen (1992). Current contamination data has been compiled from other sources, along with ecological pathways and lists of all wildlife and plants at the site, including threatened and endangered species. This information has been published in Weiss and Mitchell (1992).

1.4.3 Cultural Resources Review

In compliance with Section 106 of the National Historic Preservation Act (NHPA), and at the request of Westinghouse Hanford Company (WHC), the Hanford Cultural Resources Laboratory (HCRL) conducted an archaeological survey during Fiscal Year 1991 of the 100 Area reactor compounds on the DOE Hanford Site (Chatters et al. 1992). This survey was conducted as part of a comprehensive cultural resources review of the 100 Area CERCLA operable units in support of CERCLA characterization activities. The work included a literature and records review and pedestrian survey of the project area following procedures established in the *Hanford Cultural Resources Management Plan* (PNL 1989).

The 100 B/C Area consists of approximately 441 ha, of which nearly 30% (133 ha) was surveyed. Most of this operable unit is on the gently sloping Pleistocene terrace ranging from 133 m above sea level on the north edge to 153 m above sea level at the southern boundary. The remainder of the area is a steeply sloping bank (1:10, i.e. 10%, grade) that extends down to the Columbia River shoreline. An extensive gravel beach is exposed along the north boundary of the operable unit at low water. On the upstream end of the operable unit, the bank is less steep, broadening into a gently sloping (1:50, i.e., 2%, grade) gravel flat, 150 m wide. Archeological survey efforts were concentrated along the shoreline and the undisturbed periphery around the reactor complex.

Two archaeological sites (H3-17 and 45BN446) and a single isolated artifact (45BN430) were located within the 100 B/C Area. Site H3-17 is located on the high terraces occupied by the reactor facilities and may be affected by CERCLA characterization studies. Site 45BN446 is at risk because it may be located near frontage roads or launch facilities and may be affected indirectly by CERCLA activities.

Evaluation of the significance of all sites discovered in fiscal year 1991 will be conducted in the future. The DOE is currently considering negotiating a programmatic agreement with the Washington State Historic Preservation Office, the Advisory Council for Historic Preservation, and affected Native American Tribes to aid in the mitigation of affects to significant historic properties that are within or affected by contamination from CERCLA operable units. All work and road building associated with CERCLA characterization of the 100 Areas will be reviewed by HCRL and DOE personnel and plans will be adjusted to avoid impacts to cultural resources whenever possible.

Figure 1-1 Map of the 100-BC Area Showing Source and Groundwater Operable Units

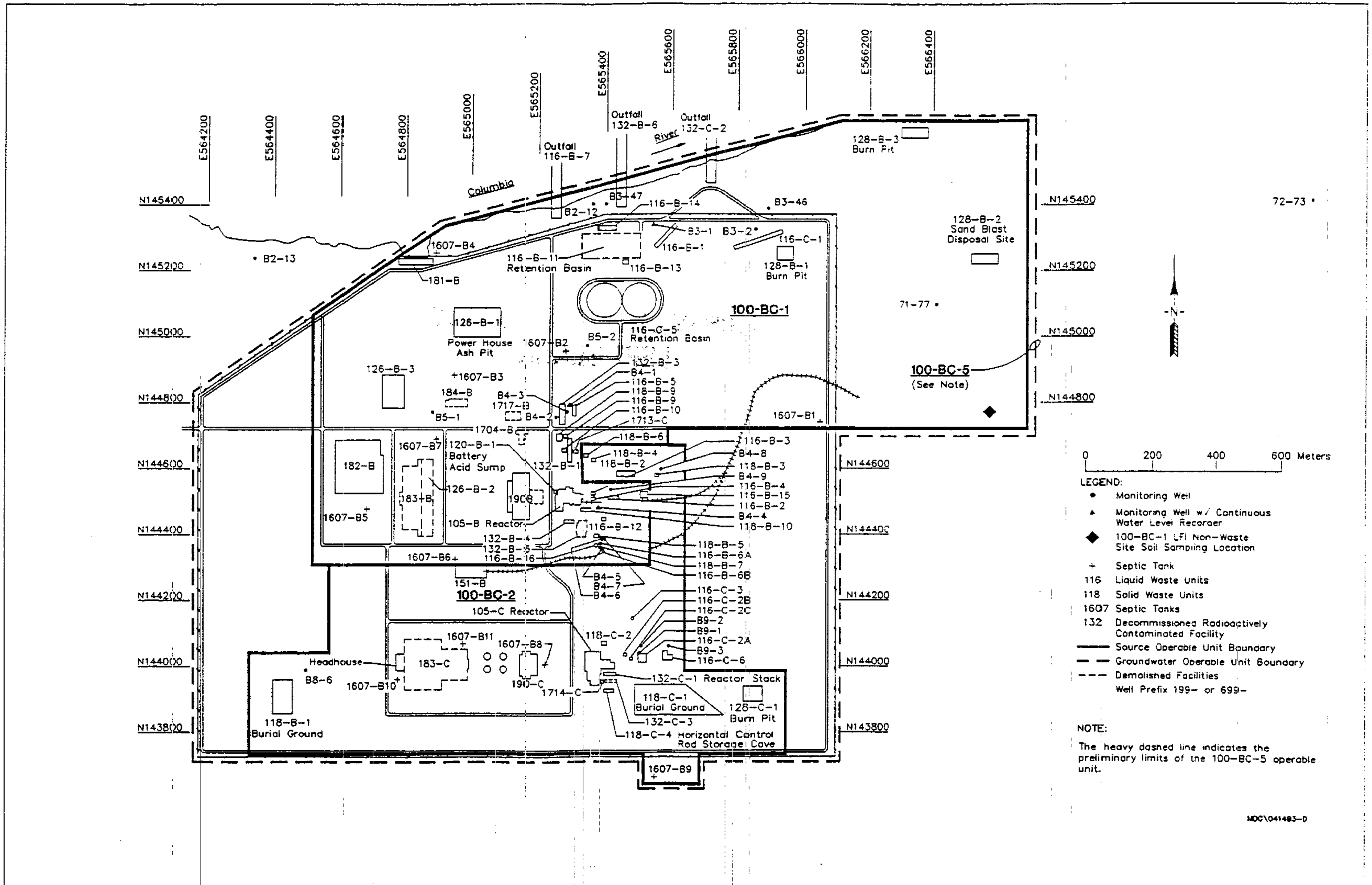

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Figure 1-2 Hanford Past-Practice Strategy Decision Flow Chart

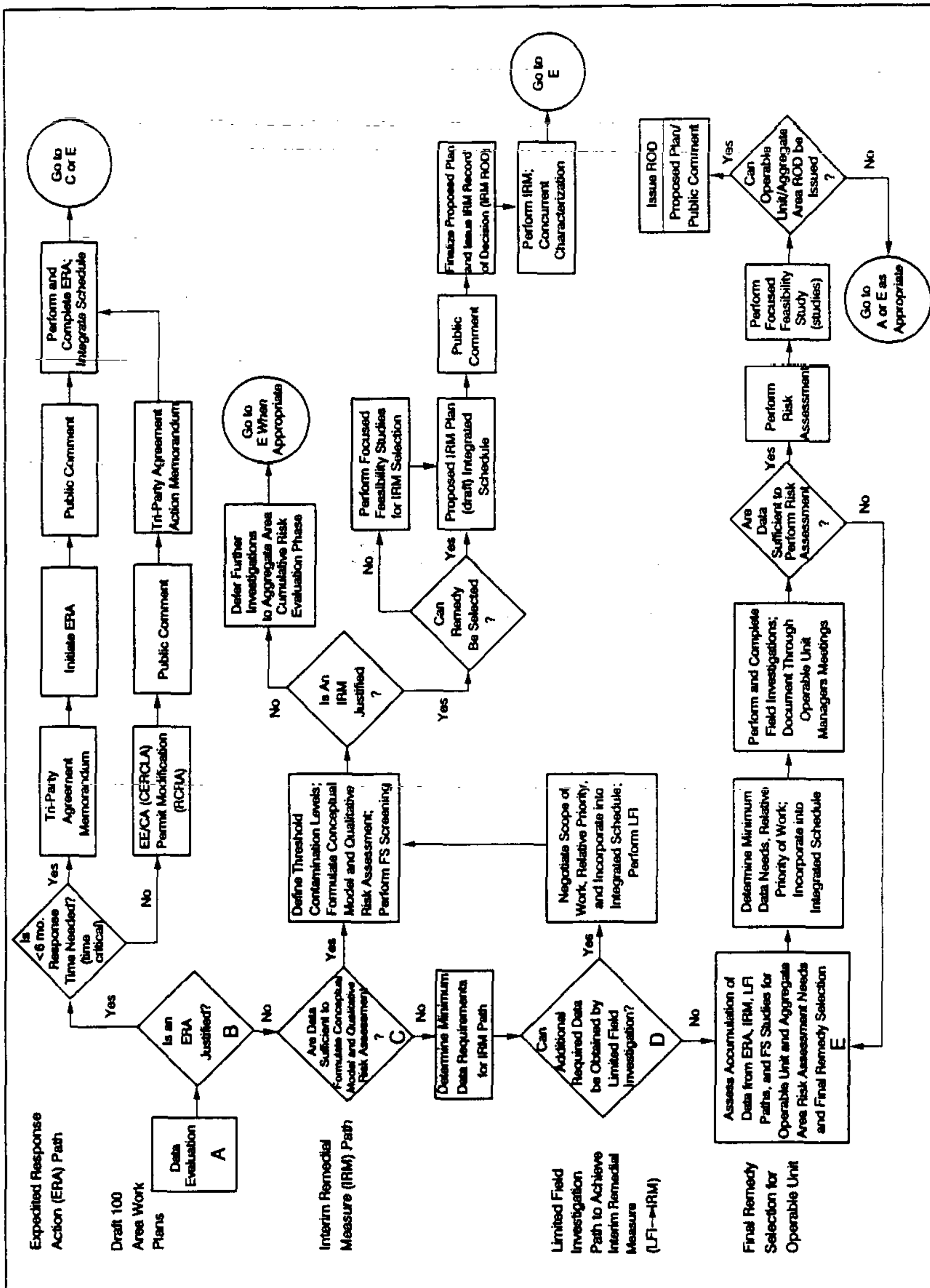

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Table 1-1 100-BC-1 Operable Unit Characterization Activities (page 1 of 2)

Task	Title	Where Addressed
1	Project Management	Accomplished throughout project
2	Source Investigation	See subtasks below
2a	Source Data Compilation and Review	Background information is incorporated into the work plan, QRA and LFI reports as appropriate.
2b	Surveying	Coordinates and locations of sampling sites are documented in the LFI report (Chapter 3).
2c	Field Activities	Source sampling results for the 116-C-5 retention basins are in the LFI report.
2d	Source Sample Laboratory Analysis and Data Validation	Analytical results and data validation are documented in data validation reports referenced in Chapter 2 of LFI report
2e	Source Data Evaluation	The data was evaluated for use in the QRA and also evaluated in the LFI report.
3	Geologic Investigation	Coordinated through the 100-BC-5 operable unit tasks.
4	Surface Water and Sediments Investigation	Not applicable to 100-BC-1
5	Vadose Zone Investigation	See subtasks below
5a	Data Compilation	See subtask 2a
5b	Borehole Soil Sampling and Logging	Results of the borehole investigations and borehole logs are presented in the LFI report (Chapter 3).
5c	Soil Sample Analysis	The analysis and validation are documented in the data validation reports referenced in LFI report (Chapter 2).
5d	Geophysical Logging	The results of the geophysical logging are reported in the LFI report (Chapter 3, and Appendix B).
5e	Data Evaluation	The data was evaluated for use in the QRA and also evaluated in the LFI report.

Table 1-1 100-BC-1 Operable Unit Characterization Activities (page 2 of 2)

Task	Title	Where Addressed
6	Groundwater Investigation	Performed as part of the 100-BC-5 operable unit activities.
7	Air Investigation	Routine health and safety monitoring was performed during the field activities.
8	Ecological Investigation	A discussion of the ecological investigation is included in the LFI report (Section 1.4.1).
9	Other Tasks	See subtask below
9a	Cultural Resource Investigation	A discussion of the cultural resource investigation is included in the LFI report (Section 1.4.2).
10	Data Evaluation	Evaluation and interpretation of the data is accomplished in the QRA and LFI reports. The evaluation of the data for other purposes such as Large Scale Remediation, FS activities and treatability testing is ongoing.
11	Risk Assessment	The data generated during the LFI was used in the QRA and will be used in the baseline risk assessment in the future.
11a	Human Health Evaluation	QRA and summarized in LFI report (Chapter 4)
11b	Ecological Evaluation	QRA and summarized in LFI report (Chapter 4)
12	Verification of Contaminant- and Location-Specific ARARs.	ARARs will be addressed in the FS report and FFS report. ARARs also discussed in LFI report (Chapter 3).

ARAR - Applicable or Relevant and Appropriate Requirements
FS - Feasibility Study
FFS - Focused Feasibility Study
LFI - Limited Field Investigation
QRA - Qualitative Risk Assessment

Table 1-2 100-BC-1 Operable Unit High-Priority Sites and Low-Priority Sites

High-Priority Sites	Low-Priority Sites
116-B-1 Trench*	1607-B1 Septic system
116-C-1 Trench+	1607-B2 Septic system
116-B-11 Retention basin+	1607-B3 Septic system
116-C-5 Retention basin*	1607-B4 Septic system
116-B-2 B-reactor fuel storage basin trench*	1607-B5 Septic system
116-B-3 Pluto crib*	1607-B6 Septic system
116-B-5 Maintenance shop and decon pad crib*	1607-B7 Septic system
116-B-7 Process effluent outfall+	1716-B Gas station/garage area
132-B-6 Process effluent outfall+	Underground chemical tanks
132-C-2 Process effluent outfall+	Coal ash storage yard
Process pipe (sludge)+	Electrical facilities
Process pipe (soil)+	120-B-1 Battery acid sump
116-B-13/14 Retention basin sludge trenches+	126-B-1 Ash pit
118-B-5 Ball 3x burial ground	126-B-3 Coal pit demolition and inert waste landfill
116-B-6B Crib+	128-B-1 Burning pit
116-B-4 Dummy decontamination french drain+	128-B-2 Sand blast disposal site
116-B-9 French drain	183-B Filter plant
116-B-10 Dry well	118-B-9 Storage building
116-B-12 Crib+	
118-B-7 Solid waste burial site	
132-B-4/5 Demolished facility	
116-B-6A Crib+	
118-B-10 Solid waste burial ground	
128-B-3 Burn Pit	
126-B-2 Clearwells	

* = Additional sampling conducted as part of a limited field investigation
+ = Additional data from an analogous facility
• = Selected sites in 100-BC-1 and 100-BC-2 sampled for contamination by polychlorinated biphenyl

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Table 1-3 Summary Statistics and Upper Threshold Limits for Inorganic Analytes

Analyte	95% Distribution[a] (mg/kg)	95% UTL[b] (mg/kg)
Aluminum	13,800	15,600
Antimony	NR*	15.7[c]
Arsenic	7.59	8.92
Barium	153	171
Beryllium	1.62	1.77
Cadmium	NR	0.66[c]
Calcium	20,410	23,920
Chromium	23.4	27.9
Cobalt	17.9	19.6
Copper	25.3	28.2
Iron	36,000	39,160
Lead	12.46	14.75
Magnesium	7,970	8,760
Manganese	562	612
Mercury	0.614	1.25
Nickel	22.4	25.3
Potassium	2,660	3,120
Selenium	NR	5[c]
Silver	1.4	2.7
Sodium	963	1,290
Thallium	NR	3.7[c]
Vanadium	98.2	111
Zinc	73.3	79
Molybdenum	NR	1.4[c]
Titanium	3,020	3,570
Zirconium	47.3	57.3
Lithium	35	37.1
Ammonia	15.3	28.2
Alkalinity	13,400	23,300
Silicon	108	192
Fluoride	6.4	12
Chloride	303	763
Nitrite	NR	21[c]
Nitrate	96.4	199
Ortho-phosphate	3.7	16
Sulfate	580	1,320

Source: DOE-RL 1993c
* NR= Not Reported
[a] 95th percentile of the data for a lognormal distribution
[b] 95% confidence limit of the 95th percentile of the data distribution
[c] Limit of detection

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2.0 INVESTIGATIVE APPROACH

The 100-BC-1 LFI utilized intrusive and non-intrusive methods to investigate all the high-priority sites identified in the work plan (DOE-RL 1992a). Intrusive methods included sampling and subsequent analysis of soil and sediment, and borehole geophysical logging. Non-intrusive methods included ground penetrating radar (GPR) surveys, evaluation of data collected from analogous sites by LFIs at other 100 Area operable units, evaluation of historical data, and a QRA. The GPR surveys were used solely to establish the location of boreholes. Intrusive sampling activities took place at sites 116-B-1, 116-B-2, 116-B-3, 116-B-5, and 116-C-5. Data from intrusive LFI investigations of analogous sites in the 100-DR-1 Operable Unit and 100-HR-1 Operable Unit were applied to the LFI evaluation of the 100-BC-1 sites such as the outfall structures, 116-B-12 crib, and 116-B-4 french drain. Each of the reactors and their support facilities in the 100 B/C, 100 H, and 100 D/DR Areas are similar in construction and use. An analogous site is a site associated with one of the other 100 Area reactors which has a similar process history, waste stream. and expected suite of contaminants to a site in the 100-BC-1 Operable Unit. An analogous site does not necessarily have the same geology or contaminant concentrations. Table 2-1 presents 100 Area analogous sites. Non-intrusive investigations of the other 100-BC-1 high-priority sites relied on historical data from past sampling and analysis, such as Dorian and Richards (1978), and process knowledge. Table 2-2 lists the LFI approaches applied to the high-priority sites.

Intrusive investigations of the 100-BC-1 Operable Unit high-priority sites were performed using two sampling methods. Boreholes were drilled and vadose zone samples collected at four liquid waste disposal sites, i.e., cribs and trenches, to identify the nature and vertical extent of contamination. Test pits were excavated to sample sludge deposits in the 116-C-5 retention basins and also to sample a potentially contaminated area outside of the 116-C-5 west retention basin where there was historical evidence of contamination caused by effluent overflow.

Intrusive investigations of the 100-BC-1 Operable Unit low-priority sites were performed using manual surface sampling. Surface soils at a non-waste site location and at selected electrical facilities were sampled manually. The samples collected at the non-waste site location were analyzed for the same analytes as the waste site samples. The data are provided for information only. Surface soils at electrical facilities in the 100 B/C Area that were visibly contaminated were sampled to investigate the presence of PCB contamination. This sampling was not part of the 100-BC-1 LFI; these facilities are not under consideration as IRM candidates and the facilities are low-priority sites. The data are presented for information only.

The investigative methods utilized are proven methods which allow appropriate sample extraction. After the desired samples were taken, they were shipped off site for laboratory analysis. The analytical results were returned for validation and evaluation. The following sections describe the LFI process in detail.

2.1 BOREHOLES

Four vadose zone boreholes were drilled through high-priority liquid waste sites during the 100-BC-1 LFI. Additional boreholes were also drilled as part of the 100-BC-5 LFI. Boreholes were advanced using cable tool drilling methods and sampled with split-spoon samplers in accordance with the *Description of Work for the 100-BC-1 Operable Unit Vadose Investigation Activities* (Day 1992). Cable tool drilling was used for this task because of the gravels, cobbles and boulders common to the operable unit, and because the quantity of drilling residuals is minimal and can be easily controlled compared to other drilling methods. Detailed procedures for borehole drilling are described in the *Environmental Investigations and Site Characterization Manual*, Environmental Investigation Instruction (EII) 6.7, (WHC 1988).

Target depths for the boreholes were established based on process knowledge and historical records. These information sources provided the expected depth below grade of the specific liquid waste structure/facility. The boreholes were drilled through the bottom of the trench or crib structure into the underlying native sediment and advanced until field screening instruments indicated that contamination was less than the screening action levels in two consecutive samples removed from the borehole. Section 2.6 provides details of the field screening methods. The maximum allowed total depth of any vadose zone boreholes was restricted to no more than 1.5 m (5 ft) below the water table. After total depth of a borehole was reached a spectral gamma geophysical log was run, and the borehole was abandoned in accordance with EII 6.7 (WHC 1988).

2.2 TEST PITS

Two types of test pits were dug, both at the 116-C-5 retention basins. One test pit was excavated outside the west retention basin to investigate an area where effluent leaked from the basin. Three test pits were excavated inside the east and west basins to sample sludge that is present on the steel basin floor. The test pits were dug in accordance the *Source Investigation Field Activities for the 100-BC-1 Operable Unit Description of Work* (Stankovitch 1992) and EII 5.2, Appendix I (WHC 1988) using a backhoe bucket to extract the soil material and to remove fill material that overlies the retention basin sludge. Samples of the retention basin sludge were collected manually using a stainless steel spoon in accordance with EII 5.2, Appendix A (WHC 1988), after the fill was removed. Samples at the vadose test pit were taken from the bucket as described in Section 2.7.2.

2.3 SURFACE SAMPLING

Surface sampling of soils was performed in accordance with EII 5.2, Appendix A (WHC 1988) at the non-waste site location described in Section 3.23 and at selected electrical facilities discussed in Section 3.24. This sampling was performed manually using decontaminated stainless steel spoons and bowls. Discrete and composite samples were collected. Specific details for sampling are provided in Sections 2.7.3 and 2.7.4.

2.4 PHYSICAL PROPERTIES SAMPLING

Physical properties samples were taken in support of "EPA Physical Sampling Criteria for the 100 Areas", Attachment 1 of the 100-BC-1 Operable Unit Work Plan (DOE-RL 1992a). The physical property samples were analyzed for the following parameters using American Society for Testing and Materials (ASTM) methods. Bulk density and K_{unsat} were calculated:

- bulk density
- particle size distribution (ASTM D422-63)
- moisture content (ASTM D2216)
- moisture retention (ASTM D2325-68, D3152-72)
- saturated hydraulic conductivity (K_{sat}) (ASTM D2434-68)
- unsaturated hydraulic conductivity (K_{unsat}) at 10% moisture content after full saturation.

2.5 GEOPHYSICAL BOREHOLE LOGGING

The WHC high resolution, passive spectral gamma-ray radiation logging system (RLS) was used to perform geophysical borehole logs during the 100-BC-1 LFI in accordance with EII 11.1 (WHC 1988). The RLS borehole surveys identify the presence of man-made gamma-ray emitting radionuclides, their concentration, and location in the borehole interval. The system provided graphs of radionuclide concentration in pCi/g versus depth for each man-made radionuclide identified in the vadose boreholes. The concentrations and locations of naturally occurring gamma-ray emitting isotopes of potassium, uranium, and thorium are also recorded during the RLS surveys.

The RLS system includes a liquid nitrogen-cooled high purity germanium (HPGe) detector or sonde, a cable and draw works system which moves the sonde in the borehole and records the depth of the sonde, instrumentation and data recording systems, computers and associated software, calibration systems, and data manipulation software. The RLS system is truck-mounted. The HPGe sonde and the RLS were set up in the standard configuration which is designed to detect low decay activities (low concentrations) of radionuclides. In this configuration the RLS has frequently shown a minimum activity detection capability of 0.3 pCi/g for radionuclides that emit gamma-rays with energies above 500 keV and number of gammas per decay above 50%. The maximum activity that the RLS has detected in the standard configuration is about 10,000 pCi/g. The maximum decay activity detected by the RLS during the 100-BC-1 LFI was 1000 pCi/g of ^{137}Cs in borehole 116-B-3. Copies of borehole spectral gamma-ray geophysical logs which were obtained during limited field investigations in 100-BC-1 Operable Unit are in Appendix B. The complete results of borehole spectral-gamma ray geophysical are presented in *Spectral Gamma-Ray Log Report for 100 Area Borehole Surveys* (WHC 1993c).

2.6 FIELD SCREENING

During drilling, sediments were continuously screened using portable on-site instruments for radionuclides and VOCs (DOE-RL 1992a). The screening was used to assist in the selection of sample intervals and borehole total depths. The field geologist screened for VOCs using an organic vapor monitor (OVM) that was used, maintained, and calibrated consistent with EII 3.2 (WHC 1988) and EII 3.4 (WHC 1988). The action level for volatile organic screening was 5 ppm above background.

Radionuclides were also screened per EII 3.4 (WHC 1988). Radionuclide screening was performed by the field geologist or field team leader using a Ludlum model 14-C scintillation counter to measure levels of beta-gamma ($\beta\gamma$) activity. The field geologist recorded screening results in the borehole log per EII 9.1 (WHC 1988). The action level for radionuclide screening was twice background, except at the 116-B-3 site, as described in *Description of Work for the 100-BC-1 Operable Unit Vadose Investigation Activities* (Day 1992). Because the 116-B-3 site background was 5000 cpm $\beta\gamma$, a condition attributable to nearby B Reactor, the action level was established as 7200 cpm $\beta\gamma$ (Day 1992).

Chromium screening was performed on sediment collected at borehole total depth using a portable hexavalent Cr test kit per EII 3.4 (WHC 1988). The Cr screening was done for informational purposes only and was not used to make decisions in the field.

2.7 SOIL AND SLUDGE SAMPLING

Soil sampling intervals in boreholes and test pits were selected on the basis of field screening results and the predicted waste site target depths. Soil removed from the borehole or test pit was screened continuously for VOCs and radioactivity. The borehole or test pit was deepened until either sediment was encountered that exceeded the field screening action level, or the maximum expected waste site target depth was reached. Once action levels were exceeded, sampling then continued at 1.5 m (5 ft) intervals until either two consecutive sample intervals did not exceed the action level, or the borehole had reached a depth 1.5 m (5 ft) below the water table. If sediment did not exceed the action levels and the maximum expected waste site target depth had been reached, sampling then continued at 1.5 m (5 ft) intervals until two consecutive samples did not exceed the action levels.

2.7.1 Vadose Boreholes

Samples were collected using a split-spoon sampler per the 100-BC-1 Operable Unit Work Plan (DOE-RL 1992a) and EII 5.2, Appendix B (WHC 1988). Soil cuttings were continuously screened per the criteria stated in Section 2.6 from the surface to the final depth.

2.7.2 Test Pits

Samples from the vadose zone test pit were collected directly from the backhoe bucket using hand tools and standard soil sampling techniques per EII 5.2, Appendix I (WHC 1988). A bucket of soil was removed from the desired sampling interval and brought to the side of the test pit for sampling. Samples were collected from soil in the middle of the bucket, away from the bucket sides. Excavated soil was continuously screened per the criteria stated in Section 2.6 from the surface to the final depth. Sample depths were estimated using measured dimensions of the backhoe bucket and arm.

Samples of sludge from the retention basin test pits were collected manually from the sludge layer using hand tools and standard soil sampling techniques per EII 5.2, Appendices A and I (WHC 1988), after the backhoe had removed overlying fill material.

2.7.3 Non-Waste Site Soil Sampling

Two surface soil samples were collected at a location about 0.1 mile east of the railroad crossing on Route 1 (B Avenue) (Figure 1-1). At each sample location the 0.0 to 0.5 ft interval below land surface (bls) was removed with a stainless steel spoon that had been decontaminated per EII 5.5 (WHC 1988). The sample was then collected from the 0.5 to 1.0 ft bls interval using a second, decontaminated stainless steel spoon per EII 5.3 (WHC 1988). Soil for VOC analysis was collected and bottled first. The remaining sample bottles were filled after sufficient soil was collected into a decontaminated stainless steel bowl and homogenized. The sampling was performed in accordance with EIIs 5.1, 5.2, 5.4, 5.5, and 5.11 (WHC 1988).

2.7.4 Electrical Facility Sampling

Surface soil that appeared visibly contaminated, e.g., appeared oil-stained or discolored, was selected for sampling. The samples were collected in accordance with EII 5.2, Appendix A (WHC 1988). Sample collection activities were documented in a field logbook number WHC-N-429-1.

2.8 SAMPLE ANALYSIS

Samples collected from the boreholes and test pits for chemical analysis were analyzed for the full suite of CERCLA Contract Laboratory Program (CLP) Target Compound List (TCL) and Target Analyte List (TAL) constituents, specific anions that may be present, and radionuclides. The CLP TCL constituents are VOCs, semi-vols, pesticides, and PCBs. The CLP TAL constituents include metals and cyanide. Chemical analysis was conducted using CLP methods. Appendix A presents a summary of the analytical data set.

Samples from electrical facilities were analyzed for PCBs following CLP protocols using EPA SW-846 Method 8080 (EPA 1987).

Analytical methods, routine analytical detection and quantitation limits, and precision and accuracy specified for the methods are listed in Table QAPjP-1 of the Quality Assurance Project Plan in the 100-BC-1 Operable Unit Work Plan (DOE-RL 1992a).

2.9 DATA VALIDATION

Data validation was performed by a qualified independent participant contractor. The validation responsibilities are defined in associated statements of work. All validation was performed in compliance with WHC *Sample Management Administration Manual* (WHC 1990), Section 2.2 for organics analyses, Section 2.1 for inorganic analyses and Section 2.3 and 2.4 for radionuclide analyses. All data packages were assessed. The chemical and radionuclide data were validated. The physical property data were not validated. The following reports present the data validation process:

- *Data Validation Report for the 100-BC-1 Operable Unit Vadose Boreholes* (WHC 1992a).
- *Data Validation Report for the 100-BC-1 Operable Unit 116-C-5 Test Pit* (WHC 1992b).
- *Data Validation Report for the 100-BC-1 Operable Unit Vadose Test Pit Samples* (WHC 1992c).
- *Data Validation Report for the 100-BC-1 Operable Unit Electrical Facilities* (WHC 1992d).
- *Data Validation Report for the 100-BC-5 Operable Unit Soil Sampling* (WHC 1992e).
- *Data Validation Report for the 100-DR-1 Operable Unit Vadose Sampling* (WHC 1992f).
- *Data Validation Report for the 100-HR-1 Operable Unit Vadose Boreholes* (WHC 1992g).

In addition to the data validation identified above, the LFI data were evaluated for use in the LFI and QRA. The data evaluation process is discussed below.

The first step in the data evaluation process was to develop a detailed inventory of all samples collected for the LFI. This information was gathered from the project sample list, borehole logs, sample tracking sheets, and sample location maps. Multiple information sources were reviewed as no one source contained all required information.

The second step was to compile and review the analytical data. This was done to verify that validation results are incorporated into the analytical database and that data qualifiers are listed. Rejected data were assigned the qualifier "R". Data rejected for major quality deficiencies (e.g. technical concerns) were not used, however data rejected for administrative reasons, (e.g., calibration data delivered late) were used after the calibration data became available and the sample and corresponding calibration data were reviewed. Sources of data for the evaluation were Hanford Environmental Information System (HEIS), CLP analysis data disks, validated analytical reports, i.e., "form 1" sheets, and CLP data packages.

The third step was to review trip, equipment, and field blank data to determine if sample data detections were due to sources other than media contamination. This review was conducted using the EPA's "five or ten times rule". The ten times rule applies to common laboratory contaminants, e.g., 2-butanone, acetone, methylene chloride, toluene, and common phthalate esters. Detected concentrations of common lab contaminants had to be greater than 10 times their corresponding blank value to be considered valid. Detected concentrations of other contaminants had to be greater than five times their corresponding blank value to be considered valid.

One result of the data evaluation and validation process is the assignment of data qualifier letter codes to individual analytical results. The following qualifier letter codes were applied to data from the LFI:

- "U" indicates that the analyte was analyzed for and not detected. The numerical value reported is the contract required detection limit (CRDL) or the contract required quantitation limit (CRQL). Contract required detection limits apply to EPA CLP protocol analyses of inorganic constituents and to detection limits established by WHC for radionuclide analyses. Contract required quantitation limits apply to EPA CLP protocol analyses of organic constituents. Sample quantitation limits and sample detection limits may be lower or higher than CRQLs or CRDLs, depending on instrumentation, matrix, and concentration factors.

- "J" indicates that the analyte was analyzed for and detected. The concentration reported is an estimate due to identified quality control (QC) deficiencies. For example, if the amount present is less than either the CRDL or CRQL, the concentration reported is considered an estimated value.

- "UJ" indicates the analyte was analyzed for and not detected. The detection or quantitation limit for the sample can only be estimated due to identified QC deficiencies.

- "JN" indicates the analyte was analyzed for and that there is presumptive evidence for the presence of the analyte. The concentration reported is considered an estimate usable only for information purposes.

- "E" indicates the analyte was analyzed for and detected at a concentration outside the calibration range of the instrument. The reported concentration is an estimate possibly containing significant error.

- "R" indicates that the data were rejected during validation by the independent contractor because of quality assurance problems or for administrative reasons. Many sets of data from radionuclide analyses were marked "R" during the validation process because the instrument calibration data arrived late from the analytical laboratory. Evaluation of the radionuclide analytical results and the calibration data during the qualitative risk assessment indicated the analytical data were usable, although the "R" qualifier code was retained.

- "B" indicates that the analyte was detected in the sample and in the blank associated with the sample.

Data marked with "J" or "R" qualifiers were used for the LFI and QRA as were data that had no qualifiers attached. Data that were marked with "U" or "UJ" qualifiers were not used. Data that were marked with "B" qualifiers were evaluated using the EPA five and ten times rule to assess if they were usable.

Table 2-1 100 Area Analogous Sites

Waste Site Description	100-B/C Area Site	100-D/DR Area Site	100-H Area Site
Process Effluent Disposal Trench	116-B-1	116-DR-1 116-DR-2	116-H-1
Fuel Storage Basin Trench	116-B-2	116-D-1a 116-D-1b	none
Dummy Decontamination French Drain	116-B-4	none	116-H-3
Process Effluent Retention Basin	116-B-11 116-C-5	116-D-7 116-DR-9	116-H-7
Reactor Confinement Seal Pit Drainage Crib	none	116-D-9	116-H-9
Process Effluent Outfall Structure	116-B-7 132-B-6 132-C-2	116-D-5 116-DR-5	116-H-5
Process Effluent Pipelines	Process Effluent Pipelines	Process Effluent Pipelines	Process Effluent Pipelines
Effluent Pumping Station	none	132-D-3	132-H-3
Exhaust Air Filter Building	132-B-4	117-D	132-H-2
Pluto Crib	116-B-3 116-C-2	116-D-2a	116-H-4
Gas Recirculation Building	132-B-5	115-D	none

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Table 2-2 LFI Investigation Activities for 100-BC-1 Operable Unit High-Priority Sites (page 1 of 2)

Site	Name - Size	Comments	LFI Approach
116-B-1	Effluent disposal trench - 61m x 9m x 5m deep	Received high activity effluent produced by failed fuel elements	B, C, P, G, F, R, H
116-C-1	Effluent disposal trench - 152m x 15m x 8m deep	Received high activity effluent produced by failed fuel elements	H, AB, AC, AG, AF, AR
116-B-11	Retention basin - 142m x 70m x 6m deep	Held cooling water effluent from B Reactor for cooling/decay before release to the Columbia River	H, AB, AC, AG, AF, AR
116-C-5	Retention basins (two) - 101m diameter x 5m deep	Held cooling water effluent from B and C Reactors for cooling/decay before release to the Columbia River	T, C, H, F, E
116-B-2	Fuel basin storage trench -23m x 3m x 5m deep	Received high activity water from B Reactor fuel storage basin; water contaminated when fuel element was cut in half	B, C, G, F, R, H
116-B-3	Pluto crib - 3m x 3m x 3m deep	Received high activity effluent from B Reactor process tubes contaminated by fuel element failures	B, C, G, F, H
116-B-5	Crib - 26m x 5m x 3m deep	Received low-level waste from contaminated maintenance shop and decontamination pad in 108-B building including liquid tritium waste	B, C, G, F, R, H
116-B-7 and 132-B-6	Outfall structures - sump 8.2m x 4.2m x 6.4m deep	Discharged cooling water effluent and process sewer effluent to Columbia River	AB, AC, AG, AF, H
132-C-2	Outfall structure - sump 8.2m x 16m x 6.4m deep	Discharged cooling water effluent and process sewer effluent to Columbia River	AB, AC, AG, AF, AR, H
Process Effluent Pipelines	Total length about 2100m, pipe diameter 76cm, 122cm, and 167cm, buried 6m bls	Transported reactor cooling water from reactors to retention basins, outfall structures, 116-B-1 and 116-C-1 trenches	AC, AF, AT, H
116-B-13	South sludge trench - 15m x 15m x 3m deep	Received sludge from 116-B-11 retention basin	H
116-B-14	North sludge trench - 37m x 3m x 3m deep	Received sludge from 116-B-11 retention basin	H
118-B-14	Burial ground - 15m x 15m x 6m deep	Probably used as burial ground for activated reactor components	H
116-B-6B	Crib - 4m x 2.4m x 2m deep	Received radioactive liquid waste from equipment decontamination at 111-B building decontamination station	H
116-B-4	French drain - 1.2m x 6m deep	Received spent acid from dummy decontamination facility	AC, AB, AG, AF, AR, H

Table 2-2 LFI Investigation Activities for 100-BC-1 Operable Unit High-Priority Sites (page 2 of 2)

Site	Name - Size	Comments	LFI Approach
116-B-9	French drain - 1.2m x 0.9m deep	Received waste water from P-10 storage building drain	H
116-B-10	Dry well - 0.9m x 2m deep	Received liquid decontamination wastes from 108-B facility	H
116-B-12	Confinement seal crib - 3m x 3m x 3m deep	Received drainage from confinement seal system in 117-B building seal pits	AB, AC, AG, AF, AR
118-B-5	Ball 3X burial ground - 15m x 3m x 3m deep	Highly contaminated reactor components removed from B Reactor	H
118-B-7	Burial ground - 2m x 2m x 2m deep	Miscellaneous solid waste, e.g., decontamination materials and associated equipment	H
132-B-4	Demolished building - 18m x 12m x 11m high and tunnels - 58m long	Contaminated building demolished in place, buried, covered with fill	H
132-B-5	Demolished building - 51m x 22 - 30m x 9.5m tall	Contaminated gas recirculation building demolished in place, buried, covered with fill	H
116-B-6A	Crib - 3.7m x 2.4m x 4.6m deep	Radioactive waste from equipment decontamination at 111-B equipment decontamination station	H
128-B-3	Coal ash and demolition waste site - size undefined	Coal ash and demolition waste, site also used for burning of office waste, waste paint, and solvent	H
126-B-2	Clear wells - 229m long x 41m wide	Demolition waste from above ground portion of the pump room	H

bls = below land surface
A = Information from analogous site in 100 Area. The types of information are identified by a second letter code, i.e., B, C, F, G, and R, to form a two letter identifying code for data, e.g., AB, AC, AG, AF, and AR. Data types corresponding to letters B, C, F, G, and R are identified below.
B = Vadose zone borehole - drilling, geologic logging, and sampling
C = Chemical and radionuclide analysis of samples
P = Physical properties analysis of samples
G = Borehole spectral gamma-ray geophysical log
F = Field screening for radioactivity, volatile organic compounds, and hexavalent Cr
R = Ground penetrating radar to position boreholes
T = Test pits
H = Analysis of historical data including prior sampling and radiological analysis
Note that analogous site ecological data such as mouse burrow, ant mound, and vegetation analyses are available from other 100 Area operable units.

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3.0 INVESTIGATION RESULTS AND CONCLUSIONS

This chapter presents results and conclusions from the investigations of the high-priority sites, of selected low-priority electrical facilities, and sampling conducted at two non-waste site locations. Sections 3.1 through 3.6 address the five high-priority sites where intrusive field activities occurred. Sections 3.7 through 3.22 address the non-intrusive investigations that occurred at the remaining high-priority sites. Section 3.23 addresses the 100-BC-1 non-waste site soil sampling. Section 3.24 presents results of sampling at 100-BC-1 and 100-BC-2 electrical facilities. Section 3.25 presents a summary of potential ARARs for the 100-BC-1 Operable Unit.

The following types of data are presented in discussions of the high-priority sites:

- Site location, size, characteristics, history, and expected contaminants
- Geologic data obtained during the investigation
- Analysis of results from off-site laboratory analyses of sediment samples for volatile organic compounds, semi-vols, metals, pesticides, PCBs, radionuclides, and on-site laboratory analyses of physical properties. Data validation qualifier codes associated with specific analyses are included in tables at the end of Chapter 3 and in the analytical data appendices.
- Field screening data collected using hand-held instruments during sampling. Field screening was intended to assist in selection of sample intervals and to determine the depth at which drilling and sampling was stopped. Field screening data are qualitative; the identification of specific constituents and their concentrations are provided by analytical results from the off-site labs.
- Borehole spectral gamma geophysical logging results
- Results of the comparison of data collected during the 1992 LFI and data from previous "historical" investigations at the site.
- Data applicable to the 100-BC-1 LFI that were obtained from the vadose zone during the limited field investigation of the 100-BC-5 Groundwater Operable Unit.
- Concentrations of ^{3}H, ^{90}Sr, and ^{99}Tc in groundwater from monitoring wells downgradient and upgradient of the high-priority sites are reviewed to assess the potential impact on groundwater in the uppermost unconfined aquifer. These data were obtained during the 100-BC-5 LFI.

Data from analyses of sediment samples collected during drilling of boreholes for 100-BC-5 monitoring wells are included in sections that address the nearest 100-BC-1 high-priority site. These sites and wells are 116-B-2 (Well 199-B4-9), 116-B-14

(Well 199-B3-47), 116-C-1 (Well 199-B3-46), and effluent pipelines south of 116-C-5 (Well 199-B5-2). Well 199-B5-1 was not located near any of the 100-BC-1 high-priority waste sites. Data from Well 199-B2-12 was not used to assess site 116-B-14 since Well 199-B3-47 is closest to the site. Data from the chemical and radiological analyses of the sediment samples from these boreholes are included in the *Data Validation Report for the 100-BC-5 Operable Unit Soil Samples* (WHC 1992e).

Six new wells were installed in the 100-BC-1 Operable Unit area as part of the 100-BC-5 LFI. These wells were 199-B2-12, 199-B3-46, 199-B3-47, 199-B4-9, and 199-B5-1. Well 199-B2-12 monitors the uppermost confined aquifer. Water-level elevation data collected during the 100-BC-5 LFI indicate that the hydraulic potential is generally upward. The remaining wells are completed in the uppermost unconfined aquifer. The wells were designed and located to provide data on quality of groundwater entering the Columbia River and to provide data to evaluate contaminants near known waste sources. The 100-BC-5 LFI was not intended to fully characterize the groundwater operable unit.

There are currently no waste or effluent discharges in the operable unit. The average annual precipitation and evapotranspiration are about equal (DOE-RL 1992a). Waste sites near the Columbia River (e.g. within 300 m) may be affected by changes in groundwater elevations of the uppermost unconfined aquifer which is known to fluctuate in response to changes in river stage, and reversals of groundwater gradient are known to occur (DOE-RL 1992a). No contaminant transport modeling was performed as part of the 100-BC-1 or 100-BC-5 LFIs.

The assessments of current impact to groundwater are presented in subsections of this chapter that discuss each high-priority liquid waste site. The scope of the groundwater assessment is limited by the available wells. Specific limitations are as follows:

- Current impacts to groundwater from specific high-priority waste sites near the retention basins, i.e., 116-B-11, 116-C-5, 116-B-1, 116-B-13, 116-B-14, are not resolvable by wells 199-B3-1, 199-B3-47, and 199-B5-2. These sites are best assessed as a single source area.

- Assessment of current impacts to groundwater from the outfall structures is not possible since there are no downgradient wells.

- Assessment of current impacts to groundwater from the effluent pipelines is not possible with the available set of monitoring wells.

- The assessment of current impacts to groundwater from the 116-B-3 and 116-B-4 sites is somewhat uncertain given the available set of monitoring wells.

3.1 116-B-1 LIQUID WASTE DISPOSAL TRENCH

This unlined trench was 122 m (400 ft) east of the 116-B-11 retention basin, as shown on Figure 3-1. It was approximately 61 m x 9 m x 5 m deep (200 ft by 30 ft by 15 ft deep), was in use from 1946 to 1955, and received an estimated 60 million ℓ (16 million gal) of cooling water effluent (Stenner et al. 1988). The effluent was highly contaminated cooling water produced by the failure of fuel element cladding and diverted from the 116-B-11 retention basin. Radionuclide contaminants in this effluent included fission products such as ^{90}Sr, ^{99}Tc, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, and transuranics such as ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am.

In addition to radionuclide contamination, approximately 7 kg (15 lb) of sodium dichromate are estimated to have been disposed into this trench (Stenner et al. 1988). The sodium dichromate was added to the cooling water to produce a 2 mg/ℓ concentration in order to control corrosion (DOE-RL 1992a).

The 116-B-1 vadose borehole location is shown on Figure 3-2.

3.1.1 Geology

This site is characterized by sandy gravel fill to a depth of 21 ft bls. Sandy gravel is also present from 21 to 28 ft bls, the total depth of the borehole. The contact between native and imported gravel was identified on the basis of resistance to drilling penetration and a slight color change.

3.1.2 Soil Samples

Four samples were collected and submitted for chemical and radionuclide analysis from the 116-B-1 vadose zone borehole. Table 3-1 presents the borehole location survey coordinates, sample intervals, analytical laboratory, analyses performed, and the environmental data transmission numbers associated with each sample. The environmental data transmission number identifies the sample raw analytical data file. Samples were also collected for analysis of physical parameters as discussed in Section 3.1.3.

3.1.2.1 Chemical Analysis. No VOCs, semi-vols, pesticides, or PCBs were detected.

Chromium, Mn, and Zn were detected in concentrations above the Hanford Site background 95% UTL (Table 3-2). The elevated levels of Cr and Zn occur in sample B05XY1, collected 17 ft bls. An elevated concentration of Mn was found in sample B05XY4, collected 19 ft bls.

3.1.2.2 Radionuclide Analysis. The following radionuclides were detected: ^{14}C, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{238}Pu, ^{239}Pu, and ^{241}Am. Table 3-3 summarizes the detected radionuclide concentrations. Gross alpha levels were 2 to 9 pCi/g. Gross beta levels ranged from 201 pCi/g in sample B05XY1 to non detected. Concentrations of radionuclides are highest in the 15 ft to 17 ft interval bls in sample B05XY1, and decrease generally with depth in samples B05XY4, B05XY5, and B05XY6.

3.1.2.3 Field Screening. The well site geologist performed field screening for VOCs using an OVM photoionization detector (PID). Ambient VOC background during drilling ranged from 0.2 to 2.5 ppm in the upper 16 ft of the borehole. Ambient VOC background in the interval between 16 ft and 28 ft bls was 0.8 ppm. In the 0 to 16 ft interval observed levels of VOCs were not above background. In the interval from 19 to 22 ft bls observed VOC levels ranged from 2.3 to 6.0 ppm. The highest VOC levels occurred at 19 ft bls (6.0 ppm), and at 22 ft bls (3.8 ppm). From 22 ft bls to the total depth of 28 ft bls, VOC levels ranged from 0.0 to 0.3 ppm.

The well site geologist performed field screening for radioactivity using a Ludlum 14C portable scintillation detector with a gross gamma probe. A heath physics technician (HPT) performed a second field screening of beta-gamma activity using a Geiger-Mueller detector with a P-11 probe. The site gross gamma background was 2200 cpm. The gross gamma field screening action level was 5000 cpm. The maximum observed gross gamma and beta-gamma levels were 14,000 and 250 cpm in the 15.0 - 17.0 ft bls interval. The gross gamma action level was not exceeded in the interval from 17 ft to 27 ft, borehole total depth. Table 3-4 lists the observed gross gamma and beta-gamma levels for the entire borehole.

The well site geologist also performed an analysis for hexavalent Cr on soil from 27 ft bls. No Cr was detected.

3.1.2.4. Geophysical Logging. The borehole was logged from 0 to 23 ft bls; 5 ft less than total depth. The radionuclides ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{154}Eu were detected. The maximum activity was found at 16 ft bls. The intervals of occurrence, and depths of maximum decay activity for each radionuclide are presented in Table 3-5. Copies of the logs are in Appendix B. The long count gamma ray spectra acquired at 23 ft bls confirmed the presence of ^{137}Cs, ^{152}Eu, and ^{154}Eu. Drilling ended before the maximum extent of man-made radionuclides was reached; the activity of ^{154}Eu was increasing in the 20 to 23 ft interval bls after decreasing over the 16 to 20 ft interval.

3.1.3 Physical Properties Samples

Two samples were taken in conjunction with the 116-B-1 borehole investigation for physical properties analysis. The samples were analyzed as described in Section 2.4.

3.1.3.1 Sampling Data. Split tube samples were collected from borehole 116-B-1 at 22 - 23 ft and 27 - 27.5 ft bls. The well site geologist described the sediments as dry, dense, sandy gravel composed of about 50% sand and 50% gravel. Blow counts varied from 170 to 180 to advance the sampler two feet. Both samples were collected in the vadose zone.

3.1.3.2 Discussion of Physical Properties. Laboratory sieve analyses showed that the sediment grain size in the 22 to 23 ft interval bls consisted of 55% gravel, 35% sand, and 10% silt and clay. The sediment grain size in the 27 to 27.5 ft interval bls consisted of 70% gravel, 20% sand, and 10% silt and clay. The specific gravity (sG) was determined for both the coarse and fine fraction of the samples. The average sG for the two sample intervals was 2.61. The bulk density was 1.97 g/cc in the sample from 22 to 23 ft interval bls and 2.14 g/cc for the sample from the 27 to 27.5 ft interval bls.

The moisture content of the 22 ft and 27 ft samples was 0.7% and 1.66%, respectively, confirming the relative dryness of the materials.

The hydraulic conductivity varied from 1.6E-03 to 8.0E-04 cm/s; these values are quite low for sandy gravels. The low hydraulic conductivity could be the result of the 10% silt and clay reported by the grain size analysis.

The porosity of the 22 ft sample was 25.41% while that of the 27 ft sample was 16.90%. The effect of the decreasing porosity was noted in the decrease of permeability from 22 ft to 27 ft.

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3.1.4 Conclusions

No organic compounds were detected. The concentration of Cr in the 15 ft to 17 ft interval bls 33 mg/kg (sample B05XY1) collected during the LFI is above the Hanford Site background 95% UTL (27.5 mg/kg) and is considered a potential contaminant of concern. Historical data for organic and inorganic, non-radionuclide constituents are not available for comparison.

Radionuclide contamination at the 116-B-1 site was expected in the 5 ft to 20 ft bls interval, with the maximum contamination in the 15 ft to 20 ft bls interval, as shown by Figure 3-3 (Dorian and Richards 1978). Field screening data and borehole geophysical logs collected during the LFI did not reveal any radionuclides in the 0 ft to 13 ft interval; they were found from 13 ft to 27 ft bls (Figure 3-3). The radionuclides present in samples collected from borehole "B" in 1976 (Dorian and Richards 1978), decayed to 1992 concentrations, and the concentrations of the same radionuclides found by the LFI are presented in Table 3-6. Note that borehole "B" was located midway along the trench long axis while borehole 116-B-1 was near the inlet end of the trench. The separation between boreholes is about 100 ft. The 116-B-1 borehole location was chosen in an attempt to encounter the maximum levels of contamination.

Historical data show that the 17 ft bls sample interval from borehole "B" contained the highest levels of the radionuclides except for ^{90}Sr, which showed a maximum concentration in the 20 ft sample (Dorian and Richards 1978). Analytical data from LFI borehole 116-B-1 samples show the maximum concentrations of radionuclides, including ^{90}Sr, occur in the 15 ft to 17 ft interval bls. All radionuclide concentrations in the soil samples decreased as depth increased. Radionuclides were detected in the deepest sample, collected from the 25 to 27 ft bls interval. The borehole geophysical log indicated that the maximum vertical extent of contamination was not reached at the maximum logged depth of 23 ft bls, four feet less than total depth. The concentrations of radionuclides from boreholes "B" and 116-B-1 are within an order of magnitude; as a generalization, concentrations are slightly higher in the LFI samples. The exceptions in LFI borehole 116-B-1 are ^{155}Eu and ^{238}U; ^{238}U was not detected and ^{155}Eu was not reported.

Three sites considered to be analogous to the 116-B-1 site located in other 100 Area source operable units have been examined thus far by LFIs. These are 116-DR-1, 116-DR-2, and 116-H-1. To assess the concept that these sites are analogous, a comparison of radionuclide and chemical analytical results from the LFI samples was performed. The analytical data are compiled in the data validation reports for each operable unit (WHC 1992a, WHC 1992f, and WHC 1992g) The radionuclide contaminants present in samples from the four sites are similar. Chromium is a contaminant, i.e., present in concentrations greater than the 95% UTL, in three of the four sites. Chromium is not a contaminant at site 116-DR-2, Cd and Ag are. At site 116-DR-1, Cr and Ag are contaminants. At site 116-H-1, Cr, As, and Pb are considered contaminants. Volatile organic compounds were found at the three of the four sites, but not at 116-B-1. The compounds detected are toluene, acetone, and methylene chloride. Semi-volatile compounds were detected in three of the four sites, but there was little consistency of compounds between the sites. No PCBs or pesticides were found at the four sites.

3.1.5 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc and ^{3}H, concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B3-1 is downgradient of 116-B-1. Groundwater samples from this well have elevated concentrations of ^{90}Sr and ^{99}Tc relative to upgradient wells 199-B5-2 and 199-B4-8. The ^{3}H concentrations were not elevated in well 199-B3-1 relative to the same upgradient wells. The 116-B-1 site contains ^{90}Sr. Technetium-99 is a fission product that would have been present in effluent resulting from fuel cladding failures. Technetium-99 was not found in soil samples from the 100-BC-1 and 100-BC-5 boreholes. The monitoring well data indicate there is current impact to groundwater although waste sites 116-B-11, 116-B-13, and 116-C-5 may also be contributing contaminants.

3.2 116-B-2 FUEL STORAGE BASIN TRENCH

This trench, 23 m by 3 m by 5 m deep (75 ft by 10 ft by 15 ft deep), was reportedly used once in 1946 for contaminated water from the B Reactor fuel storage basin, then backfilled with soil. The water was contaminated when a fuel element was accidently cut in half and fell into the basin. Radionuclide contaminants in the contaminated water included fission products such as ^{90}Sr, ^{99}Tc, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, and transuranics such as ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am. An estimated 4 million ℓ (1 million gal) of effluent was discharged to this trench (Stenner et al. 1988). The location of the 116-B-2 borehole is shown by Figure 3-7.

3.2.1 Geology

The 116-B-2 site was covered by a minimum of 14.6 ft of fill composed of silty sandy gravel. The interval from 14.6 ft to 15.1 ft consisted of silty clay with gravel. Clay occurs in two intervals: one at 15.1 ft to 16.0 ft bls and the other at 17.8 ft to 18.4 ft bls. Between the two clay intervals is silty sandy gravel (16.0 ft to 17.8 ft). The interval from 18.4 ft to 23.5 ft bls, the total depth, consists of silty sandy gravel.

3.2.2 Soil Samples

Four samples were collected and submitted for chemical and radionuclide analysis from the 116-B-2 vadose zone borehole. Table 3-7 presents borehole location survey coordinates, sample intervals, analytical laboratory, analyses performed, and the environmental data transmission numbers associated with each sample. The environmental data transmission number identifies the sample raw analytical data file.

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3.2.2.1 Chemical Analysis. Volatile organic compounds were detected in two samples collected in the interval 20 to 22 ft bls. Toluene and 4-methyl-2-pentanone, also known as methyl isobutyl ketone (MIBK) were detected in sample B05Y22. The concentrations are 3 and 11 μg/kg respectively. Toluene was also detected in sample B05Y23 in a concentration of 52 μg/kg. Toluene has numerous industrial and commercial uses. Uses of toluene include; gasoline additive; solvent for paints, coatings, gums, adhesives, plastic resins, and rubber; feedstock in the chemical industry; raw material for explosives; and analytical chemistry (Sax and Lewis 1987). Uses of MIBK include solvent for paints, varnishes, nitrocellulose lacquers, chemical manufacture, organic synthesis, and extraction processes including the extraction of uranium from fission products (Sax and Lewis 1987). No other VOCs were detected.

The semi-volatile organic compounds, N-nitrosodiphenylamine and pyrene were detected in sample B05Y20, which was collected 12 ft below grade. The concentrations present, 110 and 39 μg/kg, were less than the CRQLs. N-nitrosodiphenylamine is used in the manufacturing of rubber; local sources or uses of the compound are an enigma. Pyrene is a coal tar derivative often found in creosote.

No pesticides or PCBs were detected.

No metals or inorganic compounds were detected in concentrations above the Hanford Site background 95% UTL.

3.2.2.2 Radionuclide Analysis. Table 3-8 presents a summary of the detected radionuclides. Gross alpha levels were 2.26 to 2.93 pCi/g. Gross beta levels were 123 pCi/g in sample B05Y20 collected 12.0 ft bls and not detected in other samples. The following radionuclides were detected: ^{14}C, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{238}Pu, ^{239}Pu, and ^{241}Am. As shown in Table 3-8, concentrations of the radionuclides are highest in the 9.7 to 12 ft interval in sample B05Y20, and generally decrease with depth in samples B05Y21, and B05Y22.

3.2.2.3 Field Screening. The well site geologist performed field screening for VOCs using an OVM PID. Ambient VOC background at the start of drilling was 0.0 ppm, but was not recorded thereafter. The VOC field screening action level was 5 ppm. The observed VOC levels in three intervals were above background: 1.7 ppm at 9.7 to 12.1 ft, 2.3 ppm at 15.1 to 17.8 ft, and 0.9 ppm at 20.0 to 22.5 ft. In the rest of the borehole VOC concentrations ranged from 0.0 to 0.1 ppm. At the borehole total depth of 23.5 ft the observed VOC concentration was 0.0 ppm.

The well site geologist performed field screening for radioactivity using a Ludlum 14C portable scintillation detector with a gross gamma probe. A HPT performed a second field screening of beta-gamma activity using a Geiger-Mueller detector with a P-11 probe. The site gross gamma background was 2350 cpm. The site gross gamma field screening action level was 4700 cpm. The observed gross gamma (λ) and $\beta\lambda$ activities were greatest in the interval between 7.6 to 15.1 ft bls, ranging from 2900 to 8000 cpm λ and from 200 to 700 cpm $\beta\lambda$. In the interval from 15.1 ft to 23.5 ft bls the gross gamma activity did not exceed 2600 cpm. Table 3-9 presents the observed field screening radioactivity data for the entire borehole.

The well site geologist also performed an analysis on soil from 22.5 ft bls for hexavalent Cr. No Cr was detected.

3.2.2.4 Geophysical Logging. The 116-B-2 borehole was logged from 0 to 20 ft bls, 2.5 ft less than total depth. The radionuclides ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{154}Eu were detected. The maximum activity was found at 10 ft bls. The intervals of occurrence and depths of maximum decay activity for each radionuclide are presented in Table 3-10. The long count gamma ray spectra acquired at 20 ft bls did not detect any man-made radionuclides.

3.2.3 Well 199-B4-9 Vadose Zone Data

Four samples and one QC split sample were collected and submitted for chemical and radionuclide analysis during the drilling of 100-BC-5 LFI borehole for monitoring well 199-B4-9. The intervals sampled, in ft bls, were 16 to 18, 26 to 28, 30 to 31.5, 60 to 63, and 67 to 71. The QC sample was collected in the 67 to 71 ft bls interval. This well is located downgradient of the 116-B-2 trench, as shown in Figure 3-4. Well 199-B4-9 is 48 m north of the 116-B-2 borehole site.

3.2.3.1 Geology. The 199-B4-9 borehole was drilled to a total depth of 92.8 ft bls. The water table was encountered during drilling at 75 ft bls, and the well was screened in the 60 to 80 ft bls interval. The sediments from 0 to 85 ft bls consisted of sandy gravel with an interval of silty sandy gravel between 8 ft and 24 ft bls. The sediments found from 85 ft to total depth were more diverse and are listed below:

- silty sandy gravel at 85.0 - 86.0 ft bls
- gravelly sand at 86.0 - 87.0 ft bls
- sand at 87.0 - 89.5 ft bls
- gravelly sand at 89.5 - 90.5 ft bls

- sand at 90.5 - 91.5 ft bls
- sandy gravel at 91.5 - 92.8 ft bls.

3.2.3.2.1 Chemical Analyses. Acetone was detected in the 60 to 63 ft bls interval (sample B05XX8) in a concentration of 11 $\mu g/\ell$ (Table 3-11). Uses of acetone include solvent for paint, varnish, and lacquer; chemical production; cleaning and drying agent. Acetone is a typical analytical laboratory contaminant. No other VOCs were detected.

The semi-volatile organic compounds benzyl alcohol and benzoic acid were detected in two samples (Table 3-11). Sample B05XX5, collected in the 16 to 18 ft interval bls, contained 380 $\mu g/\ell$ of benzyl alcohol. Sample B05XY0, collected in the 67 to 71 ft bls interval, contained 71 $\mu g/\ell$ of benzoic acid. Uses of benzyl alcohol include ball point pen ink, solvent, perfumes, and flavors (Sax and Lewis 1987). Uses of benzoic acid include plasticizer, standard in analytical chemistry, food preservative, flavors, and perfumes (Sax and Lewis 1987). No other semi-volatile organic compounds, pesticides, or PCBs were detected.

Chromium, Cd, Hg, and Ni were detected in concentrations above the Hanford Site background 95% UTL (Table 3-12). The elevated levels of Cr occurred in all the sample intervals.

3.2.3.2.2 Radionuclide Analyses. The following radionuclides were detected: ^{22}Na, ^{58}Co, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{154}Eu, ^{226}Ra, ^{228}Th, ^{235}U, ^{238}U, $^{239/240}$Pu, and ^{241}Am. Table 3-13 summarizes the detected radionuclide concentrations. Gross alpha level ranged from 13 pCi/g (sample B05XX8) to 3.7 pCi/g (sample B05XX9). Gross beta levels ranged from 110 pCi/g (sample B05XX8) to 3 pCi/g (sample B05XY0). The maximum radionuclide concentrations occur in the 16 to 18 ft bls interval and include, 8.97 pCi/g ^{60}Co, 13.7 pCi/g ^{137}Cs, 2.91 pCi/g ^{154}Eu, 0.35 pCi/g ^{241}Am, and 1.1 pCi/g $^{239/240}$Pu. In general the concentrations of the radionuclides decrease with increasing depth.

3.2.3.2.3 Field Screening. The well site geologist performed field screening for VOCs using an OVM PID. Ambient VOC background during drilling was 0.0 ppm. The VOC field screening action level was 5 ppm. At only four depths were VOC concentrations above background; 2.8 ppm at 17.5 ft bls, 0.9 ppm at 22.0 ft bls, 1.4 ppm at 61.8 ft bls, and 0.2 ppm at 92.0 ft.

The well site geologist performed field screening for radioactivity using a Ludlum 14C portable scintillation detector with a gross gamma probe. The site gross gamma background was 1800 cpm. The site gross gamma field screening action level was 3600 cpm. The maximum observed λ activities occurred in the 17.2 to 25.2 ft bls interval. They were 10,500 to 11,000 cpm from 17.2 ft to 19.6 ft bls, 4000 cpm at 20.6 ft bls, 10,000 to 14,000 cpm from 22.0 to 23.0 ft bls, and 7000 to 4000 cpm from 22.4 to 25.2 ft bls. In the intervals from 0 to 17 ft and 27 to 92.8 ft bls the λ activities ranged from 1400 cpm to 2200 cpm. The average λ activity was 1855 cpm.

The well site geologist did not perform field screening for hexavalent Cr.

3.2.3.2.4 Geophysical Logging. Well 199-B4-9 was logged from 0 to 78 ft bls, 10 ft less than total depth. The radionuclides ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{154}Eu were detected. The maximum activity was found at 19 ft bls: 13 pCi/g ^{60}Co, 60 pCi/g ^{137}Cs, 67 pCi/g ^{152}Eu. The intervals of occurrence and depths of maximum decay activity for each radionuclide are presented in Table 3-14. Copies of the logs are in Appendix B. The long count gamma ray spectra acquired at 28 ft bls did not detect any man-made radionuclides.

3.2.4 Conclusions

Samples analyzed from LFI borehole 116-B-2 did not contain significant contamination by organic compounds. The VOC data are most likely attributable to sampling media or lab contamination. Toluene is a typical laboratory contaminant. Although the analyses were not flagged with the "B" qualifier to indicate laboratory blank contamination for these specific samples, toluene was found in many laboratory blanks (WHC 1992c). Historical records do not indicate that toluene or MIBK were disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c). Separations processes that may have used MIBK occurred in the 200 Areas. No other volatile organic compounds were detected.

Sources of the low concentrations of the semi-volatile compounds N-nitrosodiphenylamine and pyrene are unknown. No metals or inorganic compounds were detected in concentrations above the Hanford Site background 95% UTL. Historical data for organic and inorganic, non-radionuclide, constituents are not available for comparison. Limited field investigation analytical data indicate that non-radionuclide contamination is not significant at the 116-B-2 site.

Radionuclide contamination at the 116-B-2 site was expected in the 15 ft to 25 ft bls interval, as shown by Figure 3-8, with the maximum activity at 15 ft bls (Dorian and Richards 1978). The expected distribution of radionuclides was based on five boreholes (A - E) located on the perimeter of the trench (Dorian and Richards 1978). Field screening during the LFI found maximum activities of γ and $\beta\gamma$ activity in the 7.6 to 15.1 ft bls interval, as shown in Figure 3-8. Limited field investigation borehole geophysical logs indicated radionuclides in the 7 ft to 18 ft interval, with maximum levels of activity, from ^{137}Cs, at 10 ft bls. Radionuclide field screening was successful in selecting the sample interval with the maximum radionuclide concentrations, as indicted by the geophysical log results and analytical data from sample B05Y20.

The maximum radionuclide concentrations found in intervals sampled by Dorian and Richards (1978), decayed to 1992, and the concentrations of the same radionuclides found by the LFI are presented in Table 3-15. Historical data (Dorian and Richards 1978) also reported 0.033 pCi/g of ^{134}Cs in sample D20. That concentration decayed to 1992 is 0.00015 pCi/g. Since no ^{134}Cs was detected it is not shown on Table 3-15. The comparison shows that radionuclide concentrations are generally highest in the LFI borehole 116-B-2 at 10 to 12 ft bls (sample B05Y20). However, deeper sample intervals in borehole 116-B-2 contained considerably lesser concentrations of radionuclides than those in boreholes A, B, D, and E. The geologic borehole log from 116-B-2 reports two clay layers: at 15.1 ft to

16.0 ft bls, and at 17.8 ft to 18.4 ft bls. These clays may have reduced the vertical permeability in the immediate area of borehole 116-B-2.

Samples analyzed from well 199-B4-9 did not contain significant contamination by organic compounds. The acetone most likely reflects sampling media or lab contamination, although the analysis was not flagged with the "B" qualifier to indicate laboratory blank contamination (WHC 1992e). Sources of the benzyl alcohol and benzoic acid are an enigma. Historical records do not indicate that acetone, benzyl alcohol, or benzoic acid were disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c). The concentrations of Cd, Cr, Hg, and Ni are above the Hanford Site background 95% UTL. These constituents were not detected in concentrations above the Hanford Site background 95% UTL in 116-B-2 samples. The radionuclides detected in the well 199-B4-9 samples and by the borehole log are consistent with the constituents in 116-B-2, although the maximum concentrations in 199-B4-9 occurred 6 ft to 9 ft deeper. Well 199-B4-9 data indicate that contamination has spread 48 m north of the 116-B-2 trench. Sodium dichromate, a hexavalent chromium compound, was dissolved in the effluent discharged to the soil and to the river during reactor operations. Hexavalent chromium may have converted to trivalent chromium in the soil column at 116-B-2/199-B4-9. Trivalent chromium compounds are relatively insoluble in water. Cesium-137 is sorbed by soil, and has not been detected in groundwater. Technetium-99 is not sorbed by soil, and was not found in soil samples.

The geophysical log indicates the maximum contamination concentrations occur at 19 ft bls, although ^{137}Cs was detected at 78 ft bls.

Two sites considered to be analogous to the 116-B-2 site located in the 100-DR-1 Operable Unit have been examined thus far by LFIs. These are 116-D-1A and 116-D-1B. To assess the concept that these sites are analogous, a comparison of the radionuclide and chemical analytical results from the 100-DR-1 LFI samples, which are compiled in the data validation report (WHC 1992f) and data from 116-B-2, follows.

Radionuclides found in all three sites included ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{235}U, ^{238}U, $^{239/240}Pu$. Many radionuclide contaminants are present in samples from the 116-D-1A and 116-D-1B which were not found in 116-B-2 samples. These include ^{7}Be, ^{14}C, ^{22}Na, ^{54}Mn, ^{58}Co, ^{59}Fe, ^{65}Zn, ^{99}Tc, ^{99}Zr, ^{103}Ru, ^{106}Ru, ^{134}Cs, ^{140}Ba, ^{141}Ce, ^{144}Ce, and ^{154}Eu. At site 116-B-2 there are no inorganic or metal contaminants. At site 116-D-1A, Cr, Cd, Pb, and Ni are contaminants. At site 116-D-1B, Cr, Pb, and Zn are contaminants. Acetone was detected at site 116-B-1 and 116-D-1A, no other VOCs were detected. Semi-volatile compounds were detected at sites 116-D-1A and 116-D-1B, but there was little consistency of compounds between the sites. The pesticide beta-BHC (beta isomer of benzene hexachloride) was found at site 116-D-1A.

Although the sites can still be considered analogous, the disparities in the contaminants found in samples from 116-B-2 and from 116-D-1A and 116-D-1B indicate that there are significant differences. The most obvious reason are the operating histories; 116-B-2 was used once in 1946; 116-D-1A was used from 1947 to 1952; and 116-D-1B was used from 1953 to 1967.

3.2.5 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B4-9 is downgradient of 116-B-2. Monitoring well 199-B4-4 is upgradient of 116-B-2. The concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H in groundwater from these two wells are not appreciably different. The 116-B-2 site does not appear to be currently impacting groundwater.

3.3 116-B-3 PLUTO CRIB

The 116-B-3 pluto crib, 3 m by 3 m by 3 m deep (10 ft by 10 ft by 10 ft deep), was excavated in 1951 to receive contaminated cooling water resulting from fuel cladding failures. Radionuclide contaminants in this effluent included fission products such as ^{90}Sr, ^{99}Tc, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, and transuranics such as ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am. The crib was in use in 1951 and 1952 to receive an estimated 4000 ℓ (1000 gal) of waste, then was retired and backfilled (Stenner et al. 1988). The fill was extended three feet above local grade. The locations of the LFI 116-B-3 borehole indicated on Figure 3-7.

3.3.1 Geology

The 116-B-3 pluto crib site contained ten feet of fill and three feet of fill above the original local grade. The 13 ft of fill consists of silty sandy gravel. The interval from 13 ft to the total depth of 20 ft bls, also consisted of silty sandy gravel. This interval appeared to be native material.

3.3.2 Soil Samples

Five soil samples, two of which were quality control samples, were collected and submitted for chemical and radionuclide analysis from the 116-B-3 vadose zone borehole. Table 3-16 presents borehole survey coordinates, sample intervals, analytical laboratory, analyses performed, and the environmental data transmission numbers associated with each sample. The environmental data transmission number identifies the sample raw analytical data file.

3.3.2.1 Chemical Analysis. The VOCs, acetone, 2-butanone (also known as methyl ethyl ketone [MEK], benzene, and MIBK) were detected in the three sample intervals (Table 3-17). However, only acetone was found in concentrations above its CRQL (10 μg/kg), 40 μg/kg in sample B05XZ1. The other compounds were detected in concentrations less than the CRQL. The uses of acetone are discussed in Section 3.2.3.1. Uses of MEK include solvent in nitrocellulose coatings and vinyl films, paint removers, cements and adhesives, organic synthesis, cleaning fluids, and printing (Sax and Lewis 1987). Methyl ethyl ketone is a typical laboratory contaminant. Uses of benzene include the manufacture of polymers, detergents, nylon, petrochemicals, pharmaceuticals, gasoline, and also a solvent. No other VOCs were detected.

The semi-vols, anthracene, benzo(A)anthracene, benzo(A)pyrene, benzo(B)fluoranthene, benzo(K)fluoranthene, chrysene, fluoranthene, and phenanthrene were detected in the sample collected 9.4 ft bls (Table 3-18). These compounds are typical constituents in creosote, a wood preservative. The concentrations found are less than the CRQLs. No semi-volatile compounds were detected in the other four samples collected from the vadose zone borehole at 116-B-3. No pesticides or PCBs were detected.

The concentrations of Cd (1.8 and 1.3 mg/kg), Cr (44.50 mg/kg), and Ag (3.00 mg/kg) were greater than the Hanford Site background 95% UTL (Table 3-19).

3.3.2.2 Radionuclide Analysis. The radionuclides, ^{14}C, ^{90}Sr, ^{137}Cs, ^{228}Th, ^{238}Pu, ^{239}Pu, and ^{241}Am were detected. Table 3-20 presents a summary of the concentrations. The concentrations of ^{90}Sr and ^{137}Cs are highest in the 7.4 ft to 9.4 ft interval bls in sample B05XY8, and decrease with depth. Concentrations of ^{14}C are highest 12.7 ft bls in sample B05XZ0. Gross alpha levels were 2.7 to 5.0 pCi/g. Gross beta levels were 207 pCi/g in sample B05XY8, collected 9.4 ft bls, and not detected in other samples.

3.3.2.3 Field Screening. The well site geologist performed field screening for VOCs using an OVM PID. Ambient VOC background at the start of drilling was 0.0 ppm, but was not recorded thereafter. In three intervals the observed levels of VOCs were above background, but less than the field screening action level of 5 ppm: 1.3 ppm at 7.4 to 9.4 ft, 1.5 ppm at 10.7 to 12.7 ft; and 2.8 ppm at 14.8 to 16.8 ft. The observed VOC concentration in other intervals was 0.0 ppm. At the borehole total depth of 20.0 ft the observed VOC concentration was 0.0 ppm.

The well site geologist performed field screening for radioactivity using a Ludlum 14C portable scintillation detector with a gross gamma probe. A HPT performed a second field screening of beta-gamma activity using a Geiger-Mueller detector with a P-11 probe. The site gross gamma background was 5000 cpm. The gross gamma field screening action level was 7200 cpm. Gross gamma and beta-gamma levels were greatest in the interval between 5.8 to 12.7 ft bls, ranging from 4500 to 8000 cpm λ and from 150 to 400 cpm $\beta\lambda$. All the observed gross gamma and beta-gamma levels and associated intervals are presented in Table 3-21.

The well site geologist also performed an analysis on soil from 18.5 to 20.0 ft bls for hexavalent Cr. A concentration of 0.15 ppm hexavalent Cr was detected.

3.3.2.4 Geophysical Logging. The borehole was logged from 0 to 17.1 ft bls, 2.9 ft less than total depth. The long count gamma ray spectra acquired at 17.1 ft bls detected <1 pCi/g activity from ^{137}Cs. Cesium-137 was the only man-made radionuclide detected. It was found in the 4 to 17.1 ft interval. The maximum decay activity detected was greater than 200 pCi/g in the 7 to 9 ft interval bls. Copies of the geophysical logs are in Appendix B.

3.3.3 Conclusions

Contamination was expected beginning 3 ft below local grade, as the crib was thought to be backfilled with "clean" material (Figure 3-9). No historical sampling data are available for comparison. Results from the investigation at the 116-B-3 crib indicate potential contamination by volatile and semi-volatile compounds, and confirmed the presence of Cd, Cr, and Ag in concentrations above the Hanford Site background 95% UTL. The Cr field screening test indicated 0.15 ppm hexavalent Cr in soil from the 18.5 ft to 20.0 ft bls interval. The vertical extent of Cr contamination may not have been established by the LFI borehole.

The detections of volatile compounds are most likely artifacts. Acetone and MEK (2-butanone) are typical laboratory contaminants, and they were found in many laboratory blanks (WHC 1992a). Acetone, MEK, and MIBK were reported from the 11 ft to 13 ft interval. In this interval a QC "split" soil sample was also analyzed. None of these three compounds were detected in either sample. Historical records do not indicate that acetone, benzene, MEK or MIBK were disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c).

Radionuclide contamination occurs generally at depths less than 13 ft, which corresponds to the reported 10 ft vertical dimension of the original structure. The most abundant man-made radionuclide in the crib is ^{137}Cs. Analytical data indicate the ^{137}Cs concentration is 78.58 pCi/g in the 7.4 ft to 9.4 ft interval, at about the mid-level of the crib. Sample B05XZ3, collected from the 14.8 ft to 16.8 ft bls interval, contained minimal amounts of ^{90}Sr (0.587 pCi/g), ^{137}Cs (0.253 pCi/g), and ^{241}Am (0.02 pCi/g).

The geophysical log indicates an activity of over 200 pCi/g from ^{137}Cs in the 7 to 9 ft interval. The log did not detect gamma-ray radiation attributable to any other man-made radionuclides. The long count geophysical log indicated that the ^{137}Cs concentration at 17.1 ft bls was less than 0.1 pCi/g. Field screening for radioactivity measured levels of radiation from the 12.7 ft to 20.0 ft that were less that ambient background at the surface. Limited field investigation data show that radionuclide contamination at the 116-B-3 crib does not extend beyond 17 ft bls.

One site considered to be analogous to the 116-B-3 site located in the 100-DR-1 Operable Unit has been examined thus far by LFIs. This is 116-D-2A. To assess the concept that this site is analogous, a comparison of the radionuclide and chemical analytical results from the 100-DR-1 LFI samples, which are compiled in the data validation report (WHC 1992f), and the 100-BC-1 data, follows. Radionuclides found in both sites included ^{14}C, ^{90}Sr, ^{137}Cs, ^{228}Th, ^{239}Pu, and ^{241}Am. Many radionuclide contaminants present in samples from the 116-D-2A were not found in 116-B-3 samples. These include ^{22}Na, ^{152}Eu, ^{154}Eu, ^{235}U, and ^{238}U. At site 116-B-3, Ag and Cr are contaminants. At site 116-D-2A there are no metallic or inorganic contaminants. Acetone, benzene, MEK and MIBK were detected at site 116-B-3. Acetone and methylene chloride were detected at 116-D-2A. No semi-volatile compounds were detected at the two sites. The pesticide Endrin was detected in one sample from site 116-D-2A. The facilities are probably analogous although the disparities in the contaminants found in samples from 116-B-3 and from 116-D-2A are significant.

3.3.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B4-9 is downgradient of 116-B-3, although offset about 50 m to the northeast, and also downgradient of site 116-B-2. Monitoring well 199-B4-4 is upgradient of 116-B-3. Because only these two monitoring wells are available there is uncertainty in the assessment of groundwater impact from site 116-B-3. The concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H are not appreciably different in groundwater samples from these two wells. Although the 116-B-3 site contains ^{90}Sr and likely received effluent containing ^{99}Tc, the site does not appear to be a current source of groundwater contamination.

3.4 116-B-5 CRIB

This crib, 26 m by 5 m by 3 m deep (84 ft by 16 ft by 10 ft deep), was used from 1950 to 1968. It is located just north of the former site of the 132-B-1 ^{3}H recovery facility, and received an estimated 10 million ℓ (2.6 million gal) of liquid waste, much of it contaminated with ^{3}H (Stenner et al. 1988). Only wastes with a ^{3}H activity of $<10^{9}$ pCi/ℓ ($<1\ \mu$Ci/mℓ) were discharged to the crib (Heid 1956). The location of the 116-B-5 vadose borehole is shown on Figure 3-4.

3.4.1 Geology

The 116-B-5 crib site was characterized by about 11.5 ft of fill material and air space above native sediments; this interval included the following:

0.0 - 2.0 ft	boiler ash
2.0 - 2.2 ft	concrete
2.2 - 6.6 ft	crib void (air space)
6.6 - 10.0 ft	sandy gravel
10.0 - 11.5 ft	boiler ash.

The interval from 11.5 ft to 24.6 ft, the total depth, was native material and consisted of the following:

11.5 - 13.5 ft	gravelly silty sand
13.5 - 19.0 ft	silty sandy gravel
19.0 - 22.0 ft	silty gravel
22.0 - 24.0 ft	sand.

3.4.2 Soil Samples

Three samples were collected and submitted for chemical and radionuclide analysis from the 116-B-5 vadose zone borehole. Table 3-22 presents the borehole survey coordinates, sample intervals, analytical laboratory, analyses performed, and the environmental data transmission numbers associated with each sample. The environmental data transmission number identifies the sample raw analytical data file.

3.4.2.1 Chemical Analysis. Carbon disulfide, a volatile carbon compound, and toluene, a VOC, were detected in two of the three sample intervals; 6.6 ft 8.6 ft (B05Y24) and 10.0 ft to 11.2 ft (B05Y25RE) (Table 3-23). No other volatile compounds were detected. Uses of carbon disulfide include the production of viscose rayon, cellophane, manufacture of carbon tetrachloride, and as analytical spectrophotometry solvent (Sax and Lewis 1987). Uses of toluene are discussed in Section 3.2.2.1. Toluene also occurs commonly as an analytical laboratory contaminant. No semi-volatile compounds, pesticides, or PCBs were detected.

Barium, Hg, and Zn were the only metals or inorganic compounds present in concentrations above the Hanford Site background 95% UTL (Table 3-24).

3.4.2.2 Radionuclide Analysis. The only radionuclides detected were ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, and ^{241}Am. The concentrations found were all less than 1.6 pCi/g. Table 3-25 presents the concentrations of the detected radionuclides. Gross alpha levels were 3.06 to 6.79 pCi/g.

3.4.2.3 Field Screening. The well site geologist performed field screening for VOCs using an OVM PID. Ambient VOC background throughout drilling was 0.0 ppm. The site field screening VOC action level was 5 ppm. The Site Safety Officer's (SSO) PID detected 0.6 ppm of VOCs in the crib airspace. Volatile organic compounds were not detected during drilling in any other intervals; at the borehole total depth of 24.6 ft the observed VOC concentration was 0.0 ppm.

The well site geologist performed field screening for radioactivity using a Ludlum 14C portable scintillation detector with a gross gamma probe. A HPT performed a second field screening of beta-gamma activity using a Geiger-Mueller detector with a P-11 probe. The site gross gamma background was 2280 cpm, which only the sample from 12.0 ft exceeded. The site gross gamma field screening action level was 4560 cpm. The observed gross gamma levels were greatest in the interval between 11.6 to 12.0 ft bls, ranging from 2350 to 3000 cpm. No beta-gamma activity was detected or reported. All the observed gross gamma levels and associated intervals are presented in Table 3-26.

The well site geologist also analyzed soil from 23.0 to 24.6 ft bls for hexavalent Cr. No Cr was detected.

The SSO monitored the air when the borehole penetrated the 116-B-5 crib air space for health and safety reasons using a PID, combustible gas indicator, and surveyed for nitric acid and Hg. The HPT also sampled the crib atmosphere for tritium analysis; no tritium was detected by subsequent analysis. The SSO's instruments detected 0.6 ppm of VOCs and 0.0 to 1.0 nanograms of Hg $\eta g/m^3$. No other constituents were detected in the crib atmosphere. Monitoring for Hg vapors by the SSO continued until total depth of the borehole was reached. The results are shown on Figure 3-10.

3.4.2.4 Geophysical Logging. The borehole was logged from 0 to 21.5 ft bls; 3.1 ft less than total depth. The radionuclides ^{60}Co, ^{152}Eu, and ^{154}Eu were detected. The maximum activity, < 7 pCi/g attributable to ^{152}Eu, was found 10 ft bls. The intervals of occurrence and depths of maximum decay activity for each radionuclide are presented in Table 3-27. Copies of the logs are in Appendix B. The long count gamma ray spectra acquired at 21.5 ft bls did not detect any man-made radionuclides.

Detection of ^{154}Eu was not continuous over the 3 ft to 13 ft interval. The detected activity level may have been less than the detection limit for the geophysical logging configuration used in the survey.

3.4.3 Conclusions

Historical data from three boreholes drilled and sampled in 1976 (Dorian and Richards 1978) indicated that radionuclide contamination might be expected in the 8 ft to 22.5 ft bls interval, based on samples collected at 8, 10, and 22.5 ft (Figure 3-10). The samples were analyzed for radionuclides including tritium. Results of the LFI at the 116-B-5 crib indicate potential contamination by VOCs, confirmed the presence of Ba, Hg, and Zn in concentrations above the Hanford Site background 95% UTL, and confirmed the presence of radionuclides.

The VOC detections are most likely attributable to laboratory contamination. The analysis with the largest VOC concentrations, B05Y25RE, was generated after re-extraction, hence the "RE" code, from the soil sample B05Y25 (WHC 1992c). Toluene is a typical lab contaminant. Historical records do not indicate that toluene or carbon disulfide were disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c).

Radionuclide contamination was detected in LFI samples in the 6.6 ft to 17 ft bls interval, as indicated by gross alpha levels (3.06 to 6.79 pCi/g). The following radionuclides were detected: ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, and ^{241}Am. The concentrations were all < 1.6 pCi/g (Table 3-25).

Table 3-28 presents a comparison between historical radionuclide data (Dorian and Richards 1978), decayed to 1992, and LFI data. Limited field investigation samples were not analyzed for ^{3}H so comparison to all historical data is not possible. About 10 times more ^{152}Eu was reported by Dorian and Richards (1978) in the 8 ft sample, as compared to LFI sample B05Y24. The data for the samples collected during the LFI in the 10 to 17 ft interval and by Dorian and Richards (1978) in the 10 to 22.5 ft interval are essentially equal.

The geophysical log detected activity attributable to ^{60}Co, ^{152}Eu, and ^{154}Eu. The maximum activity, <7 pCi/g of ^{152}Eu, was detected at 10 ft bls. Activity levels for ^{60}Co and ^{154}Eu were less than 1.5 pCi/g and < 1 pCi/g respectively. The long count gamma-ray spectra acquired at 21.5 ft bls did not detect any man-made radionuclides. Limited field investigation data indicate that radionuclide contamination at the 116-B-5 crib does not extend beyond 17 ft bls. The geophysical log and radionuclide analyses of soil samples both indicated maximum contamination at similar intervals, i.e., 9.6 and 10 ft bls. The radioactivity field screening indicated greater activity two feet deeper in the borehole.

There are no facilities in the 100 Area analogous to the 116-B-5 crib.

3.4.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B4-1 is located adjacent to the northwest corner of the crib. Monitoring well 199-B4-9 is upgradient of 116-B-5. The concentrations of ^{99}Tc and ^{3}H are not appreciably different between these two wells. The ^{90}Sr concentration is as much as 12% to 25% lower in the downgradient well samples. It does not appear that the 116-B-5 crib is currently impacting groundwater.

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3.5 116-C-5 RETENTION BASIN

The 116-C-5 retention basin consists of two circular, 38 million ℓ (10 million gal) open topped tanks with wooden internal baffles, constructed of welded steel sides and floors, set on reinforced concrete foundations and a crushed rock subfloor. Perforated pipes were placed in the subfloor as drains. Each tank was 5 m (16 ft) deep and 101 m (330 ft) in diameter (AEC-GE 1964). These tanks were operated from the C Reactor start up in 1952 until shutdown in 1969. The 116-C-5 basin was originally constructed to receive cooling water from C Reactor. It was used for both the C and B Reactors after 1954. Originally, only one tank was filled at a time, to allow for diversion of highly contaminated cooling water to the second tank. The practice of adding hot water to an empty cold tank resulted in cracking of the welded seams of the tanks. After a series of repair efforts extending into 1958, parallel operation of the tanks became common (Dorian and Richards 1978). Since decommissioning, 0.9 m (3 ft) of soil fill has been added over the 1.3 cm (0.5 in) of sludge in the basin. Retention basin test pit locations are indicated on Figure 3-11.

The investigation at the 116-C-5 retention basin included sampling of sludge in the east and west tanks and sampling of soil next to the west tank that was thought to have been contaminated by effluent leakage. Test pits methods were used to collect the sludge and soil samples.

3.5.1 Sludge Samples

Six sludge samples were collected and submitted for chemical and radionuclide analysis from the 116-C-5 retention basin sludge. Table 3-29 presents the sample numbers, test pit numbers, date sampled, analytical laboratory, analyses performed, and the environmental data transmission numbers associated with each sample from the west retention basin. Table 3-30 presents the same information associated with each sample from the east retention basin. The environmental data transmission number identifies the sample raw analytical data file.

3.5.1.1 Chemical Analysis. The VOC, 2-butanone (MEK), was detected in a concentration of 5.00 μg/kg in the composite sample B018V4 from the west basin. No other VOCs were detected. Uses of MEK are discussed in Section 3.3.2.1. The following semi-volatile organic compounds were detected in the east and west basin sludge samples: benzo(A)anthracene, benzo(B)fluoranthene, benzo(K)fluoranthene, chrysene, fluoranthene, and pentachlorophenol. The concentrations found were less than the CRQLs. Table 3-31 summarizes the data. These compounds are typical constituents in creosote, a wood preservative.

No pesticides or PCBs were detected.

The metals Cr, Cu, Fe, Pb, Hg and Zn occur in concentrations considerably greater than the Hanford Site background 95% UTL in many of the retention basin sludge samples (Table 3-32).

3.5.1.2 Radionuclide Analysis. The following radionuclides were detected ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{226}Ra, $^{233/234}$U, ^{235}U, ^{238}Pu, ^{238}U, $^{239/240}$Pu, and ^{241}Am. Table 3-33 presents a summary of the detected radionuclide concentrations. There is significant radioactivity in the samples, e.g., 310 pCi/g ^{60}Co, 770 pCi/g ^{90}Sr, 800 pCi/g ^{137}Cs, 1400 pCi/g ^{152}Eu, and 190 pCi/g ^{239}Pu. Maximum concentrations of ^{226}Ra, $^{233/234}$U, ^{235}U, and ^{238}U were all less than 1.5 pCi/g. Gross alpha levels ranged from non-detectable to 110.00 pCi/g. Gross beta levels ranged from 83 pCi/g to 3700 pCi/g.

The distribution of radionuclides in the basins is not uniform; this is indicated by the variation in analytical results between samples B018V1, B018V6, B018V7, and B018V8 which were collected in the east basin (Table 3-33). Sample B018V1, collected nearest to the basin discharge had the lowest radionuclide concentrations. Samples B018V7 and B018V8, collected nearest to the coolant inlet, have the highest radionuclide concentrations. Historical data (Dorian and Richards 1978) also show similar, non uniform, distributions of the radionuclides.

3.5.1.3 Field Screening. The SSO performed field screening for VOCs using an OVM PID. Observed levels at all sampling locations in the east basin were less than detectable (<0.0 ppm). Monitoring for VOCs was not conducted in the west basin because no VOCs were detected in the east basin.

The HPT performed field screening of beta-gamma activity using a Geiger-Mueller detector with a P-11 probe. The beta-gamma background ranged from 200 to 400 cpm within the east basin. The soil (fill) surface beta-gamma levels at the east basin test pit locations ranged from 800 to 6000 cpm. Beta-gamma levels were not recorded for soil (fill) surface at test pit locations in the west basin. The observed beta-gamma levels from the sludge exposed in the east basin and west basin test pits ranged from 4000 to 10,000 cpm. The observed beta-gamma levels for the soil (fill) surface are presented in Table 3-34.

3.5.2 Vadose Test Pit

The test pit was located in an area contaminated by leakage from the west retention basin. The test pit was dug to a total depth of 20 ft bls and sediment consisting of 15% to 20% sandy loam and 80% to 85% gravels and cobbles was encountered. The dimensions of the test pit, other than total depth, were not recorded. Although the site geologist recorded a description of the sediments found in the excavation a formal geologic log was not prepared. The Field Team Leader selected sample intervals following the selection criteria discussed in Section 2.7. The location of the vadose test pit is shown on Figure 3-2.

3.5.2.1 Soil Samples. Six samples, including a quality control "split" sample, were collected and submitted for chemical and radionuclide analysis from the 116-C-5 vadose zone test pit. Table 3-35 presents the sample intervals, analytical laboratory, analyses performed, and the environmental data transmission numbers associated with each sample. The environmental data transmission number identifies the sample raw analytical data file.

3.5.2.2 Chemical Analysis. No VOCs, semi-volatile organic compounds, pesticides, or PCBs were detected in soil samples from the 116-C-5 vadose test pit.

The concentration of Ba in sample B018X2, 260.00 mg/kg, collected 5.0 ft bls, exceeds the Hanford Site background 95% UTL of 171 mg/kg. The concentration of Cd in sample B018X6, 0.840 mg/kg, collected 20.0 ft bls, exceeds the Hanford Site background 95% UTL of 0.66 mg/kg. No other metals or inorganic constituents were detected in concentrations above the Hanford Site background 95% UTL.

3.5.2.3 Radionuclide Analysis. Table 3-36 presents a summary of the detected radionuclides. Gross alpha levels ranged from 3.9 to 15.0 pCi/g. Gross beta levels ranged from 16.0 pCi/g to 36.0 pCi/g. The greatest concentrations of radionuclides occur principally in sample B018X2, with the exceptions of $^{233/234}U$ in the 15 ft to 22 ft interval, and ^{14}C, ^{226}Ra, and ^{228}Th which occurred in the 20 ft to 22 ft interval.

3.5.2.4 Field Screening. The site geologist performed field screening for VOCs using an OVM PID. Ambient VOC background at the start of excavation was not recorded, however, observed levels at 0, 5, 10, 15, and 20 ft bls were all 0.0 ppm.

A HPT performed field screening of beta-gamma activity using a Geiger-Mueller detector with a P-11 probe. The beta-gamma background was 100 cpm, and the action level was 200 cpm. The maximum beta-gamma activity, 300 cpm, was observed in the interval 5.0 ft bls. All the observed beta-gamma levels are presented in Table 3-37.

The Field Team Leader performed an analysis for hexavalent Cr on two soil samples collected 20 ft bls. No hexavalent Cr was detected.

3.5.3 Conclusions

The sludge in the 116-C-5 retention basin was known to contain radioactivity based on analytical results from 1976 presented in Dorian and Richards (1978). The sludges were expected to contain elevated levels of Cr, based on reactor operations process knowledge. There was little other historical data concerning non-radionuclide contaminants that might be present in the sludges. The MEK is most likely an analytical artifact. Methyl ethyl ketone (2-butanone) is a typical laboratory contaminant. Historical records do not indicate that MEK was disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c).

Table 3-38 presents a comparison of the selected maximum radionuclide concentrations from the LFI sludge samples, the maximum values of the same radionuclides from 1976 analytical data, and 1976 radionuclide concentrations from sample location CE (Dorian and Richards 1978). Location CE was closest to LFI test pit 4 from which samples B018V7 and B018V8 were collected. These two LFI samples had the maximum 1992 116-C-5 radionuclide levels. The maximum LFI concentrations were considerably less than maximum historical concentrations, decayed to 1992, of ^{60}Co, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu. The LFI maximum values are generally less than but much closer to concentrations reported from the 1976 CE sample for ^{60}Co, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu.

The LFI data from sludge samples confirmed the presence of radionuclide and metals contamination, and indicated the presence of semi-volatile compounds possibly derived from wood preservatives.

The vadose test pit was located in an area in which reactor effluent was known to have ponded on the surface (Dorian and Richards 1978). Thus contamination was expected to be present at the ground surface. The vertical extent of radionuclide contamination was expected to extend as deep as 38 ft bls (Dorian and Richards 1978). The data from the LFI vadose test pit are compared in Table 3-39 to historical data from samples collected in boreholes W, X, and Y. Boreholes W, X, and Y were drilled nearest to the two basins; X and Y were between the basins and W just north of the east basin (Dorian and Richards 1978). Radionuclide data are presented in Dorian and Richards (1978) from the 0 ft, 5 ft, and 20 ft sample intervals of these boreholes. The concentrations detected in LFI sample B018X2 (5 ft) are similar to the range of concentrations found in the surface (0 ft) samples from borehole X and Y (Dorian and Richards 1978). In borehole Y the $^{239/240}$Pu concentration (0.72 pCi/g) is well above the level found in the LFI sample. Field screening for radioactivity and the radionuclide analyses of soil were in agreement; both indicated maximum contamination 5 ft bls.

No organic contaminants were detected in the LFI vadose test pit samples. Barium and Cd were the only non-organic, non-radionuclide constituents that are present in concentrations above the Hanford Site background 95% UTL.

The 116-C-5 retention basins are considered analogous to the 116-B-11, 116-D-7, 116-DR-9, and 116-H-7 retention basin sites. The 116-D-7, 116-DR-9, and 116-H-7 sites were sampled during the 100-DR-1 and 100-HR-1 LFIs. To assess the concept that this site is analogous, a comparison of the radionuclide and chemical analytical results from the

100-DR-1 and 100-HR-1 LFI samples, which are compiled in the data validation reports (WHC 1992f, and WHC 1992g), and the 100-BC-1 data, follows. In contrast to the many radionuclides detected in 116-C-5 sludge, i.e., ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{226}Ra, $^{233/234}$U, ^{235}U, ^{238}Pu, ^{238}U, $^{239/240}$Pu, and ^{241}Am, only ^{14}C and ^{90}Sr were detected in material sampled above the concrete floor in the other basins. The ^{14}C and ^{90}Sr were found in only one of the five samples collected from the 100-DR-1 and 100-HR-1 basins. Review of the data indicates that samples of sludge were probably not obtained at the 116-D-7, 116-DR-9, and 116-H-7 sites. For this reason it is not appropriate to assume that sludge present at the 116-C-5 site is analogous to materials in the 116-D-7, 116-DR-9, and 116-H-7 retention basins.

The radionuclide contaminants found beneath the 116-D-7 and 116-H-7 sites are similar; both sites contain ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{226}Ra, ^{228}Th, ^{235}U, ^{238}U, $^{239/240}$Pu, and ^{241}Am. There are many radionuclide contaminants found in the 116-DR-9 site that are absent at 116-D-7 and 116-H-7. These are ^{7}Be, ^{22}Na, ^{54}Mn, ^{58}Co, ^{59}Fe, ^{65}Zn, ^{99}Tc, ^{99}Zr, ^{103}Ru, ^{106}Ru, ^{134}Cs, ^{140}Ba, ^{141}Ce, and ^{144}Ce. Comparisons of metallic contaminants in samples from the three sites revealed no patterns; Ag, Cd, Cr, and Pb are the contaminants. The 116-D-7 and 116-H-7 sites have similar assemblages of organic contaminants. The 116-DR-9 site contained VOCs, semi-vols, pesticides, and PCBs that were not found in 116-D-7 and 116-H-7 samples. Because the additional radionuclides at site 116-DR-9 have not been detected in 100-BC-1 LFI samples (see Section 3.2.4), the 116-D-7 and 116-H-7 sites are better analogs than the 116-DR-9 site for the 116-C-5 and 116-B-11 vadose zone radionuclide contamination. This is also the case for pesticides and PCBs.

3.5.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring wells 199-B3-47 and 199-B3-1 are located downgradient of the retention basin although other waste sites, i.e., 116-B-1, 116-B-11, 116-B-13, and 116-B-14, are also upgradient of these wells. Monitoring well 199-B5-2 is upgradient of the retention basins. The groundwater concentrations of ^{99}Tc are not elevated in well 199-B3-47 in comparison to well 199-B5-2. The groundwater concentrations of ^{90}Sr in well 199-B3-47 are 40 to 50% larger than those in well 199-B5-2. The groundwater concentrations of ^{3}H found in well 199-B3-47 are five to six times larger than those in well 199-B5-2. The groundwater concentrations of ^{90}Sr and ^{99}Tc are elevated in well 199-B3-1 relative to upgradient well 199-B5-2, but ^{3}H concentrations are not. Specifically, the ^{3}H concentration is as much as 12% to 25% lower in the downgradient well samples. It appears that groundwater is currently impacted by the group of retention basin waste sites, e.g., 116-B-1, 116-B-11, 116-B-13, 116-B-14, and 116-C-5. However, it is not possible to attribute the contamination to a specific source.

3.6 116-C-1 LIQUID WASTE DISPOSAL TRENCH

This unlined trench is 274 m (900 ft) northeast of the 116-C-5 retention basin (Figure 1-1) and is 152 m x 15 m x 8 m deep (500 ft by 50 ft by 25 ft deep). It was used from 1952 until 1958 to receive an estimated 700 million ℓ (26 million gal) of high-activity cooling water diverted from the 116-C-5 retention basin. Its construction and use were similar to that of the 116-B-1 liquid waste disposal trench. At some time between 1958 and 1975 the trench was backfilled.

3.6.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 116-C-1 site. It is assumed that the site is underlain by sands and gravels similar to that encountered in the 116-B-1 borehole.

3.6.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 116-C-1 site data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

The 100-BC-5 Groundwater Operable Unit LFI included the installation of monitoring well 199-B3-46, located about 60 m north of the 116-C-1 site. During the borehole drilling soil samples were collected. Data from the chemical and radionuclide analyses and field screening are presented in Section 3.6.3, below.

Two test pits were dug in the 116-C-1 trench in January of 1993 to obtain contaminated soil for the 100 Area soil washing treatability test. One pit was dug mid-length, and the other at the inlet end. Radionuclide contamination was found to be greater at the inlet end of the trench. Data collected during the excavation and in subsequent analysis of the sampled materials are presented in Section 3.6.4.

3.6.3 Well 199-B3-46 Vadose Zone Data

Two samples were collected and submitted for chemical and radionuclide analysis during the drilling of 100-BC-5 LFI borehole for monitoring well 199-B3-46. The depth to groundwater was 48.7 ft during drilling. The location of the well is shown on Figure 3-4.

3.6.3.1 Geology. The borehole was drilled to a total depth of 66.8 ft. The borehole encountered the following sediments; gravelly sand in the 0 to 1.5 ft bls interval, sandy gravel from 1.5 to 21.0 ft bls, gravelly sand from 21.0 to 26.5 ft bls, and sandy gravel from 26.5 to 66.8 ft bls.

3.6.3.2 Soil Samples. Sample B05XS4 was collected from the 30 to 32 ft bls interval. Sample B05XS5 was collected from the 35 to 37 ft bls interval.

3.6.3.2.1 Chemical Analyses. Toluene was detected in 35 to 37 ft bls interval (sample B05XS5) in a concentration of 2 $\mu g/\ell$ (Table 3-40). Uses of toluene are presented in Section 3.2.2.1. No other VOCs were detected.

The semi-vols diethyl phthalate, di-n-butyl phthalate, and bis(2-ethylhexyl) phthalate were detected in both samples. The uses of phthalates include solvent, plasticizer, plastics, and insecticides (Sax and Lewis 1987).
Bis(2-ethylhexyl) phthalate is also used as a vacuum pump oil (Sax and Lewis 1987). Concentrations are listed in Table 3-40. No pesticides or PCBs were detected.

No inorganic constituents or metals were detected in concentrations above the Hanford Site background 95% UTL.

3.6.3.2.2 Radionuclide Analyses. The following radionuclides were detected: ^{90}Sr, ^{137}Cs, ^{226}Ra, ^{228}Th, ^{235}U, ^{238}U, and ^{241}Am. Table 3-41 summarizes the detected radionuclide concentrations. Gross alpha level ranged from 7.8 pCi/g (sample B05XS4) to 4.4 pCi/g (sample B05XS5). Gross beta levels ranged from 32 pCi/g (sample B05XS4) to 53 pCi/g (sample B05XS5). The maximum radionuclide concentration was 7.8 pCi/g of ^{90}Sr in the 35 to 37 ft bls interval. All the other radionuclide concentrations were <1 pCi/g.

3.6.3.2.3 Field Screening. The well site geologist performed field screening for VOCs using an OVM PID. Ambient VOC background ranged from 0.0 to 1.0 ppm. The field screening action level was 5 ppm. None of the observed field screening VOC concentrations were above ambient background.

The well site geologist performed field screening for radioactivity using a Ludlum 14C portable scintillation detector and a gross gamma probe. The site gross gamma background was 2140 cpm. The field screening action level for gross gamma activity was 4280 cpm, however, no gross gamma activity was observed that exceeded site background.

3.6.3.2.4 Geophysical Logging. Borehole spectral gamma geophysical logging was not performed at well 199-B3-46.

3.6.4 Test Pit Sampling for Soil Washing Bench-Scale Testing

Two test pits were excavated in the 116-C-1 trench to collect materials for bench-scale soil washing treatability tests. Test pit 116-C-1 was located mid-length. Total depth of test pit 116-C-1 was 20 ft. The field team leader described the sediment texture as 60% cobbles and 40% sand. Twelve 5-gal containers of sediment were collected from the 10 to 20 ft interval.

Test pit 116-C-1A was excavated at the inlet end of the trench. Total depth of the test pit was 24 ft. The field team leader estimated that 80% of the sediment in upper 5 to 7 ft was <3 inches in diameter and the remaining 20% was 3 to 6 inches in diameter. In the interval from 7 to 24 ft the sediment consisted of rounded cobbles. Ten 5-gal containers of sediment were collected from the 10 to 22 ft interval.

Dimensions of the test pits, other than total depth, were not recorded. The field team leader's description of the sediments is not sufficient for preparation of a geologic log of the test pits.

3.6.4.1 Soil Samples. Pacific Northwest Laboratory (PNL) personnel prepared a composite sample from the twelve 5-gal containers of the material collected from 10 to 20 ft interval in the 116-C-1 test pit (DOE-RL 1994). Another composite sample was prepared by PNL personnel from the ten 5-gal containers of the material from the 10 to 22 ft bls interval in the 116-C-1A test pit (DOE-RL 1994). These composite samples are the Batch I and Batch II samples, from the 116-C-1 and 116-C-1A test pits, respectively. The samples were composited in order to obtain sufficient material for the bench-scale soil washing treatability test and to minimize the variability in chemical, radiological, and physical properties that might exist in subsamples of the composite. Samples were not collected to provide data on the trench sediment chemical, radiological, or physical characteristics at specific depths.

The Batch I and Batch II samples were analyzed in accordance with the *100 Area Soil Washing Treatability Test Plan* (DOE-RL 1992d) and as described in the *100 Area Soil Washing Bench-Scale Tests* (DOE-RL 1994). The analytical results have not been validated and have not been incorporated in the HEIS database. The analytical and physical parameters of interest included:

- concentrations of inorganic constituents in the <2 mm size fraction
- concentrations of radionuclide constituents in the <2 mm size fraction
- concentrations of ^{60}Co, ^{137}Cs, and ^{152}Eu in the >2mm size fraction
- physical properties such as grain size and bulk density.

3.6.4.1.1 Chemical Analysis. The Batch I and Batch II samples were not analyzed for volatile organic compounds, semi-volatile organic compounds, pesticides, or polychlorinated biphenyls.

The inorganic constituents in Batch I and Batch II samples were analyzed using non-CLP X-ray fluorescence (XRF) methods. The following CLP TAL analytes were not measured using the XRF methods: Be, Co, Mg, Hg, Na, Th, and cyanide. Because non-CLP methods were used the data are not directly comparable to LFI data or to the Hanford Site background 95% UTL values. The Batch I and Batch II inorganic data are presented in Table 3-42; the Hanford Site background 95% UTL values are presented for information only. The Batch II sample contained 4 times more Cr, 7 times more Pb, and 10 times more Zn than the Batch I sample. Concentrations of most of the other constituents were larger in Batch II than in Batch I samples. Concentrations of Ba, Cr, Cu, Ni, Si, V, Zn, and Zr in the Batch I sample and Ba, Cr, Cu, Pb, Mn, Ni, Si, V, Zn, and Zr in the Batch II sample, both from the <2mm size fraction, may exceed the Hanford Site background 95% UTL values, as shown in Table 3-42. The inorganic contaminant concentrations appear to be greater near the trench inlet pipe.

3.6.4.1.2 Radionuclide Analysis. Table 3-43 presents a summary of the detected radionuclides in the <2 mm size fraction, and the concentrations of ^{60}Co, ^{137}Cs, and ^{152}Eu in the >2 mm size fraction of the Batch I and Batch II samples. The Batch II sample contains significantly higher concentrations of all radionuclides in comparison to the Batch I sample, with the exception of ^{238}U. For example, in the <2 mm size fraction the ^{60}Co concentrations are 525 pCi/g in Batch II and 7 pCi/g in Batch I, ^{90}Sr concentrations are 115 pCi/g in Batch II and <0.2 pCi/g in Batch I, ^{137}Cs concentrations are 5495 pCi/g in Batch II and 0.74 pCi/g in Batch I, ^{152}Eu concentrations are 2320 pCi/g in Batch II and 28 pCi/g in Batch I, and $^{239/240}$Pu concentrations are 414 pCi/g in Batch II and 0.08 pCi/g in Batch I. In the >2 mm size fraction ^{60}Co concentrations are 17.9 pCi/g in Batch II and 3.2 pCi/g in Batch I, ^{137}Cs concentrations are 759 pCi/g in Batch II and 2 pCi/g in Batch I and ^{152}Eu concentrations are 51.6 pCi/g in Batch II and 0.6 pCi/g in Batch I. The radionuclide contaminant concentrations are greater near the trench inlet pipe.

3.6.4.1.3 Field Screening. Field screening was used during the excavation at the two test pits for health and safety purposes and to collect material with sufficient radioactivity to be useful for treatability testing. Radionuclide and VOC screening was not used to establish the total depth of the test pits.

The site safety officer performed field screening for VOCs using an OVM PID at both test pits. The ambient VOC background concentration during the excavations was 0 ppm and the observed concentrations were 0 to 0.2 ppm.

A HPT performed field screening of beta-gamma activity using a Geiger-Mueller detector with a P-11 probe. The beta-gamma general background for both test pits was 50 cpm. At the 116-C-1 test pit, source of the Batch I samples, the activity was 50 cpm in the 0 to 10 ft interval had and 400 cpm in the 10 to 20 ft interval. At the 116-C-1A test pit, source of the Batch II samples, the activity was 1000 at 10 ft bls, 600 to 1000 cpm at 15 ft bls, 3000 to 5000 cpm in the 15 to 20 ft interval, 20,000 cpm at 20 ft bls, and 1500 to 2000 cpm in the 22 to 24 interval.

3.6.4.2 Physical Properties. The sediment from each test pit was analyzed to determine the moisture content, particle size distribution, and specific gravity (DOE-RL 1994).

The moisture contents of the Batch I and Batch II samples were 2.49% and 0.85% respectively (DOE-RL 1994).

The particle size distribution of the Batch I sample, expressed in weight percent, was 90% coarse sand and gravel (>2 mm), 3.6% medium sand (2 mm to 0.25 mm), 3.4% fine sand (0.25 mm to 0.074 mm), and 3.0% silt and clay (<0.074 mm) (DOE-RL 1994). Note that reported Batch I grain-size distribution classes (DOE-RL 1994) do not match standard grain-size scales used by engineers, geologists, or soil scientists. The particle size distribution of the Batch II sample, expressed as weight percent, for the Batch II sample was 97.2% gravel (>4.75 mm), 1.1% medium sand (2 mm to 0.425 mm), 0.7% fine sand (0.425 mm to 0.074 mm), and 1.0% silt and clay (<0.074 mm) (DOE-RL 1994). The grain-size classes for the particle size distribution of the Batch II sample follow the ASTM D2487-90 standard (DOE-RL 1994).

The specific gravity for the Batch II sample was 2.71, but no result was reported for the Batch I sample (DOE-RL 1994).

3.6.5 Conclusions

The 116-C-1 trench area was sampled extensively in 1975 at 15 locations. Boreholes were drilled into the soil to depths up to 11 m (36 ft). Contamination was found in and beneath the trench along the entire length, and consisted primarily of ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, and probably ^{63}Ni (not reported). In many borings, concentrations of radionuclides were still increasing at depths of 9 to 11 m (30 to 36 ft), indicating that the limits of the contaminated soil column may not have been reached. The estimated radionuclide inventory for the trench and soil column to 9 ft (30 ft) below grade was at least 79 Ci (Dorian and Richards 1978). Approximately 4.5 kg (9 lb) of sodium dichromate was also estimated to have been disposed of in the trench (Stenner et al. 1988). The sodium dichromate was added to the reactor cooling water in a concentration of 2 mg/ℓ to control process tube corrosion (DOE-RL 1992a).

Analytical data from well 199-B3-46 indicate possible contamination by toluene, phthalates, and low concentrations of radionuclides. Both toluene and the phthalate compounds are typical laboratory contaminants. Historical records do not indicate that toluene or phthalates were disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c), although vacuum pumps were used in the 100 B/C Area. The analytical data indicate only minimal contamination may be present in the vadose zone sampled by well 199-B3-46.

Analytical data from the treatability test pit samples indicate that contamination is greater at the inlet end of the 116-C-1 trench. Field screening for beta-gamma radioactivity indicated that contamination was highest 20 ft bls in the 116-C-1A test pit, excavated at the inlet end of the trench. The vertical distribution of inorganic and radionuclide contaminants and the vertical extent of contamination beneath the trench were not established by the test pit sampling, as these were not goals of the sampling and analysis. Concentrations of radionuclides in the Batch II sample are considerably larger than those reported in Dorian and Richards (1978) for borehole "L" 18 ft sample as shown in Table 3-43. The analytical data from the test pits are not directly comparable to LFI data or to historical data because the samples were composites from intervals 10 to 12 ft thick and because non-CLP methods were used for inorganic analyses.

Analytical data from the LFI sampling of the 116-B-1 trench are considered analogous and are presented in Section 3.2. Contamination levels for both radionuclides and metals for the 116-C-1 trench are assumed to be analogous to those found in the 116-B-1 LFI samples, based on operating history and process knowledge. An assessment of the similarity of data from sites considered analogous to the 116-C-1 site is presented in Section 3.1.4.

3.6.6 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B3-46 is located downgradient of 116-C-1. Monitoring wells 199-B5-2 and 199-B4-8 are the nearest upgradient wells. The concentrations of ^{90}Sr and ^{99}Tc are both elevated in samples from well 199-B3-46 relative to both upgradient wells. The ^{3}H concentrations in samples from well 199-B3-46 are about 40% to 60% larger than concentrations in samples from well 199-B4-8. Tritium concentrations in samples analyzed from the upgradient well 199-B4-8 were the same as those in July samples from well 199-B3-46, but in the October sample the downgradient well sample had 40% more ^3H. It appears that the 116-C-1 trench is impacting groundwater.

3.7 116-B-11 RETENTION BASIN

The 116-B-11 retention basin was a rectangular, reinforced-concrete reservoir, 142 m x 70 m x 6 m deep (467 ft x 230 ft x 20 ft), partially aboveground and divided into two sections by a central flume that ran the length of the basin (General Electric 1963). The basin was located on the northern edge of the 100 B/C Area (Figure 1-1). It received effluent cooling water from the B Reactor from 1944 until 1954 (Dorian and Richards 1978). After 1954, the effluent from the B Reactor was diverted to the 116-C-5 basin because the 116-B-11 basin cracked and repair efforts were unsuccessful. For at least 14 years after being retired, the 116-B-11 retention basin was purposely kept wet (Brinkman 1968). To maintain a minimum wetness, overflow water from the B Reactor fuel storage basin was routed to the retention basin. By 1975, the basin was no longer kept wet, and 1.06 m (3.5 ft) of soil fill had been added on top of the 6.4 cm (2.5 in) layer of sludge present in the bottom of the basin. The walls of the basin have been partially demolished.

Leaks from the 116-B-11 basin were extensively documented. As early as 1949, several leaks were observed in the north walls of the basin (Patterson 1949). At the same time, thermal springs appeared along the Columbia River below the basin. The springs were believed to result from the seepage of cooling water through the soil from the basin to the river. Leaks continued to occur regularly after that time. Most of these leaks were small and could be classed as seepage (Ruppert 1953). The leaks were greatest on the northeast side of the basin and around the outlet pipe on the east end of the basin. They resulted in visible surface contamination. The leak areas were not covered at that time but were fenced off and posted with radiation signs. During February 1954, a break occurred in the basin and the area around the basin was covered with water (Selby and Soldat 1958). The amount of radioactivity in the surface water surrounding the basin was comparable to effluent water. Leakage rates were estimated to be as high as 18,925 to 37,850 ℓ/min (5000 to 10,000 gal/min) (Dorian and Richards 1978). The soil surface around the basin was covered with additional soil in 1977.

The leaks resulted in widespread soil and groundwater contamination in the area of the 116-B-11 basin. The spread of the thermally hot effluent through the soil was sufficient to raise the temperature of the influent river water at the 181-B pump house by several degrees centigrade (Brown 1963). Thermally hot groundwater mounds were also formed beneath the basin.

The 100-BC-1 LFI did not include an investigation of the 116-B-11 basin. The data that follow are from analyses reported by Dorian and Richards (1978).

3.7.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 116-B-11 basin. It is assumed that the basin is underlain by sandy gravel similar to that encountered in the 116-B-1 LFI vadose borehole.

3.7.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 116-B-11 basin, data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

Historical radionuclide concentration data and conclusions for the 116-B-11 site are presented in Section 3.7.3.

3.7.3 Conclusions

There are historical data for radionuclide constituents in basin sludge, soil, or concrete. Dorian and Richards (1978) reports analyses of radionuclides in the basins sludge, overlying fill, and soil from beneath and adjacent to basins. The 116-B-11 retention basin contained a calculated inventory of approximately 118 Ci in 1976, of which 92 Ci was attributed to the 6.4-cm (2.5 in) thick sludge layer, and the remaining 26 Ci was attributed to the soil fill and the basin concrete. This inventory was based solely on sampling results. The primary radionuclides consisted of ^{60}Co, ^{63}Ni, ^{152}Eu, and ^{154}Eu. The average concentration of $^{239/240}Pu$ in the 116-B-11 basin sludge was 58 pCi/g and the maximum was 340 pCi/g. The maximum concentration of radionuclides in 116-B-11 sludge samples reported in 1978 (Dorian and Richards 1978) decayed to 1992 are as follows:

Constituent	Concentration (pCi/g)
^{3}H	102
^{14}C	260
^{60}Co	4266
^{90}Sr	210
^{134}Cs	50.5
^{137}Cs	831
^{152}Eu	28316
^{154}Eu	8224
^{155}Eu	489
^{238}U	9.0
^{238}Pu	7.7
^{239}Pu	340

Dorian and Richards (1978) reports analyses of soil from a maximum of 4 m (13.5 ft) below the basin. The same suite of radionuclides were found in the soil samples as in the sludge, although concentrations were less. The data indicated that the level of contamination is distributed irregularly in the sampled area. Concentrations at a depth of 4 m (13.5 ft) are the same order of magnitude as concentrations in shallower soil samples. This suggests that the sampling did not extend to the bottom of the contaminated zone. Based on the samples, the soil column beneath the 116-B-11 basin was estimated to contain a total radionuclide inventory of approximately 280 Ci (Dorian and Richards 1978). The contaminated soils below and around the basin are still in place. An analysis of a soil sample from outside the basin reported in 1986 (Jacques 1986) confirmed the 1978 report except that no ^{238}Pu was detected.

The 116-B-11 site is considered analogous to the 116-C-5, 116-D-7, and 116-H-7 sites. Section 3.5.3 presents an evaluation of this assumption.

3.7.4 Groundwater Assessment

The assessment of impact to groundwater posed by the 116-B-11 retention basin is addressed in Section 3.5.4.

3.8 116-B-7, 132-B-6, AND 132-C-2 OUTFALL STRUCTURES

The outfall structures were open, reinforced-concrete boxes (sumps) located on the bank above high water line and spillways that extended form the sumps to the river shore. The 116-B-7 and 132-B-6 sumps are 8.2 m x 4.2 m x 6.4 m deep. The 132-C-2 sump is 8.2 m x 16 m x 6.4 m deep. The sumps extend below grade and connect to the effluent pipelines from the retention basins. The sumps directed the effluent water through discharge lines to the bottom center of the Columbia River, except during times of high river levels, when the effluent was sent through the concrete overflow spillways to the river shoreline. Surface contamination is known to be present at the 132-B-6 spillway. The area is marked with radiation hazard posts. The other outfall structures have not been marked with radiation hazard posts to indicate that they are areas of known surface contamination.

The 100-BC-1 outfall structures were not investigated during the LFI. The 116-D-5 outfall structure is an analogous site that was investigated in the 100-DR-1 LFI during 1992. Data from the 116-D-5 borehole are applicable for the LFI evaluation of the 116-B-7, 132-B-6, and 132-C-2 sites. The 116-D-5 borehole was in proximity to the outlet side sump and near the discharge pipeline. The borehole was located there to detect possible soil contamination produced by effluent leaks from the sump or discharge pipeline, and from effluent spillage/overflow.

3.8.1 Geology

No site-specific geologic data are available for the 100-BC-1 outfall structures.

3.8.2 Soil Samples

The 116-D-5 borehole was drilled to a total depth of 27.5 ft bls. Soil samples were collected at 20 to 22 ft bls and at 25 to 27 ft bls.

3.8.2.1 Chemical Analyses. Investigation of the 116-D-5 outfall structure revealed the presence of trichloroethene (TCE). Uses of TCE include metal degreasing, dry cleaning, refrigerant and heat exchange liquid, cleaning and drying electronic components, thinner for paints and adhesives, and chemical manufacturing (Sax and Lewis 1987).

No semi-volatile organic compounds, pesticides or PCBs were detected in the 116-D-5 structure; similar findings are expected for the 100-BC-1 outfall structures.

No metals or other inorganic compounds were detected in concentrations above the Hanford Site background 95% UTL at the 116-D-5 outfall structure. Similar conditions are expected for the 100-BC-1 outfall structures.

3.8.2.2 Radionuclide Analyses. Investigation of the analogous 116-D-5 outfall structure revealed the presence ^{14}C, ^{40}K, ^{90}Sr, ^{226}Ra, ^{228}Th, ^{235}U, ^{238}U, ^{239}Pu, and ^{241}Am. All the radionuclide concentrations were <1 pCi/g, as shown in Table 3-44, except for ^{40}K (12 pCi/g).

3.8.2.3 Geophysical Logging. A borehole geophysical log was not run at this site.

3.8.3 Conclusions

The possibility of radionuclide contamination at the 100-BC-1 outfalls structures is suggested by the analogous data from 116-D-5 and known surface contamination at the 132-B-6 structure. The 100-DR-1 LFI also examined the 116-DR-5 outfall using a single borehole drilled in proximity to the outlet side of the sump and the discharge pipeline. The same radionuclides were detected in samples from borehole 116-DR-5 with the addition of ^{137}Cs. All the concentrations were <1 pCi/g except for ^{40}K (13 and 13.5 pCi/g). No VOCs were detected and there were no inorganic or metal concentrations above the 95% UTL. However, di-n-butyl phthalate, bis(2-ethyl hexyl) phthalate, butylbenzyl phthalate, and the pesticide dieldrin were detected. Uses of phthalates are presented in Section 3.6.3.1.

Historical records do not indicate that TCE, phthalates, dieldrin were disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c). The inconsistent occurrence of these organic compounds in samples from the two boreholes is not supportive of their occurrence at the 100-BC-1 outfall structures. Neither TCE or dieldrin have been found in samples from the 100-BC-1 LFI. Phthalate compounds were detected only in five soil samples from the 100-BC-1 Operable Unit, in wells 199-B3-46, 199-B3-47, and 199-B5-2. Phthalates are typical laboratory contaminants, but may have been used in vacuum pumps in the 100 B/C Area.

3.8.4 Groundwater Assessment

The available monitoring wells are not sufficient to allow an assessment of current impact to groundwater posed by the outfall structures.

3.9 PROCESS EFFLUENT PIPELINES

The retention basin system includes effluent lines from the B and C Reactors to the basins and overflow trenches, and lines from the basins to the outfall structures. Approximate locations of the major discharge lines are shown in Figure 3-1. The effluent lines from the B Reactor to the 116-B-11 basin were about 732 m (2400 ft) long between the B Reactor and the basin, and were originally 122 cm (48 in) diameter and 76 cm (30 in) diameter concrete pipes placed 6 m (20 ft) below grade. After the original pipeline leaked, it was retired and a 167 cm (66 in) diameter carbon steel line, also 6 m (20 ft) deep was installed (General Electric 1963). A segment of the effluent lines from the C Reactor to the 116-C-5 retention basins is also located within the 100-BC-1 Operable Unit boundaries. These lines were 167 cm (66 in) diameter carbon steel (General Electric 1963). The total line length from C Reactor to the 116-C-5 basin was approximately 975 m (3200 ft), but only 610 m (2000 ft) of this lies within the 100-BC-1 boundaries.

When the C Reactor and associated basins were built, a 137 cm (54 in) diameter effluent line was routed directly east from the B Reactor building, which tied into the C effluent line at a junction box 91 m (300 ft) east of the B Reactor. A second 152 cm (60 in) diameter crossover line between the B and C effluent lines was located south of the 116-C-5 basins.

Both the concrete effluent lines and the replacement steel lines from B Reactor exhibited substantial leaks. The first indications of gross leaks in the effluent lines were observed in early 1952, and they increased steadily in volume (Ruppert 1953). For a distance of approximately 244 m (800 ft) along the lines, just south of the 116-B-11 retention basin, the soil surface was covered with water and liquid was observed to be bubbling up from the subsurface (Ruppert 1953). The area was confined within a radiation zone, but there is no information to indicate that the area was covered. Two additional line leaks occurred in late 1952 near the B Reactor building (Heid 1956). One of these occurred at the diversion box for the crosstie to the C Reactor lines; the other was just northeast of the B Reactor. The areas were covered with at least 1 m (3 ft) of soil.

3.9.1 Geology

The 100-BC-1 LFI did not include a field investigation of the process effluent pipelines, junction or diversion boxes. The LFI did investigate an area analogous to areas of effluent line leakage through excavation and sampling of the 116-C-5 vadose test pit, as discussed in Section 3.5.

3.9.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the process effluent pipelines or associated junction and diversion boxes data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

The 100-BC-5 Groundwater Operable Unit LFI included the installation of monitoring well 199-B5-2. Well 199-B5-2 is about 30 m west of an effluent pipeline, and about 50 m southwest of the diversion box that served the 116-C-5 retention basin. The pipelines and diversion box are shown on Figure 3-1. During the borehole drilling soil samples were collected. Data from the chemical and radionuclide analysis are presented below.

Historical radionuclide concentration data and conclusions for the site are presented in Section 3.9.4.

3.9.3 Well 199-B5-2 Vadose Zone Data

Two samples were collected and submitted for chemical and radionuclide analysis during the drilling of 100-BC-5 LFI borehole for monitoring well 199-B5-2. The water table was encountered at 57.5 ft bls during drilling.

3.9.3.1 Geology. The 199-B5-2 borehole was drilled to a total depth of 75.0 ft bls. The borehole encountered silty sand in the 0 to 1.0 ft interval followed by sandy gravel from 1.0 ft to 63.0 ft bls. In the interval from 63.0 ft to 75 ft bls the following sediments were encountered:

- gravelly sand at 63.0 to 65.0 ft bls
- sandy gravel at 65.0 to 67.5 ft bls
- gravelly silty clay at 67.5 to 68.0 ft bls
- sandy gravel at 68.0 to 75.0 ft bls.

3.9.3.2 Soil Samples. Sample B05XX2 was collected in the 53 to 55 ft interval bls. Sample B05XX3 was collected from the 55 to 57 ft interval bls.

3.9.3.2.1 Chemical Analyses. Acetone was detected in the 55 to 57 ft bls interval (sample B05XX3) in a concentration of 24 μg/kg (Table 3-45). Uses of acetone are discussed in Section 3.2.3.1. No other VOCs were detected.

The only semi-vol detected was diethyl phthalate (Table 3-43). A concentration of 390 μg/kg was detected in the 53 to 55 ft bls interval (sample B05XX2). Uses of phthalates are discussed in Section 3.6.3.1. No pesticides or PCBs were detected.

No inorganic compounds or metals were detected in concentrations above the Hanford Site background 95% UTL.

3.9.3.2.2 Radionuclide Analyses. The following radionuclides were detected: ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{226}Ra, ^{228}Th, ^{235}U, ^{238}U, $^{239/240}$Pu, and ^{241}Am. Table 3-46 summarizes the detected radionuclide concentrations. Gross alpha level ranged from 9.4 pCi/g (sample B05XX2) to 7.3 pCi/g (sample B05XX3). Gross beta levels ranged from 36 pCi/g (sample B05XX2) to 37 pCi/g (sample B05XX3). The maximum radionuclide concentration was 2.9 pCi/g of ^{90}Sr in the 53 to 55 ft bls interval. All the other radionuclide concentrations were <1.5 pCi/g.

3.9.3.2.3 Field Screening. The site geologist performed field screening for VOCs using an OVM PID. Ambient VOC background during drilling ranged from 0.0 to 0.3 ppm. The VOC field screening action level was 5 ppm. At only two depths did the observed VOC concentration exceed background; 0.4 ppm at 16.0 ft bls, and 0.6 ppm at 24.8 ft bls.

A field geologist performed field screening for radioactivity using a Ludlum 14C portable scintillation detector and a gross gamma probe. The site gross gamma background was 2250 cpm. All of the sediments screened had gross gamma activity levels less than the site background.

3.9.3.2.4 Geophysical Logging. A geophysical log was not collected for the 199-B5-2 well.

3.9.4 Conclusions

A survey of contamination levels inside the junction boxes, diversion boxes, and effluent lines was performed as part of the 1975/1976 radiological study (Dorian and Richards 1978). Radionuclides in rust flakes and sludge samples collected from inside the lines and boxes included U, ^{3}H, ^{14}C, ^{60}Co, ^{63}Ni, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{238}Pu, ^{239}Pu, and $^{239/240}$Pu. Tritium was not found in the effluent line sample. Carbon-14 was not found in the diversion and junction boxes. The concentrations were originally reported in Dorian and Richards (1978) and are also presented in the 100-BC-1 Work Plan (DOE-RL 1992a) and in the 100-BC-1 QRA (WHC 1993a). Average total beta and gamma radioactivity levels were 83,000 pCi/g in the effluent line scale and 120,000 pCi/g in the junction box sludge (Dorian and Richards 1978). Average $^{239/240}$Pu concentrations were 66 pCi/g for the effluent line scale and 720 pCi/g for the sludge at the bottoms of the diversion and junction boxes (Dorian and Richards 1978).

Analyses conducted by Dorian and Richards (1978) did not include inorganic, metallic, or organic constituents. The LFI data for metals in the 116-C-5 sludge may be considered analogous to the sludge and scale from the pipelines, junction and diversion boxes.

Analytical data from well 199-B5-2 vadose zone samples indicate possible contamination by acetone, diethyl phthalate, and low concentrations of radionuclides. Both acetone and the phthalate compounds are typical laboratory contaminants. Historical records do not indicate that acetone or phthalates were disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c). The analytical data indicate only minimal contamination may be present in the vadose zone sampled by well 199-B5-2.

3.9.5 Groundwater Assessment

The available monitoring wells are not sufficient to allow an assessment of current impact to groundwater posed by the effluent pipelines. Because of the large volume of effluent transported by the pipelines and their history of extensive leakage they are considered to be current sources of groundwater impact.

3.10 116-B-13/14 SLUDGE BURIAL TRENCHES

These burial trenches are located near the 116-B-11 basin (Figure 1-1). The 116-B-14 trench, excavated immediately north of the 116-B-11 basin in 1948, was 37 m (120 ft) long by 3 m (10 ft) wide by 3 m (10 ft) deep. Contaminated sludge removed from the 116-B-11 retention basin was placed in the trench and covered with approximately 2 m (6 ft) of soil (Ruppert 1953). The 116-B-13 trench, measuring 15 m (50 ft) long by 15 m (50 ft) wide by 3 m (10 ft) deep was dug in 1952 southeast of the 116-B-11 basin (Clukey 1956). Again, sludge was removed from the basin, placed in the trench, then covered with about 2 m (6 ft) of clean soil (Heid 1956).

3.10.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 116-B-13/14 trenches. It is assumed that the trenches are underlain by sediments analogous to that found in the 116-B-1 vadose borehole.

3.10.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 116-B-13/14 crib data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

Historical radionuclide concentration data and conclusions for the site are presented in Section 3.10.4.

The 100-BC-5 Groundwater Operable Unit LFI included the installation of monitoring well 199-B3-47, located about 40 m north of the 116-B-14 site. During the borehole drilling soil samples were collected and geophysical logs were run. Data from the chemical and radionuclide analysis, and spectral gamma geophysical logging results are presented below.

3.10.3 Well 199-B3-47 Vadose Zone Data

3.10.3.1 Geology. The 199-B3-47 borehole was drilled to a total depth of 61.0 ft bls. The borehole encountered the following types of sediments; sandy gravel from 0 to 55.0 ft bls with caliche-cemented sand at 6.5 to 7.0 ft bls, silty sandy gravel from 55.0 to 59.0 ft bls, slightly gravelly silty sand from 59.0 to 60.5 ft bls, and sandy gravel from 60.5 to 61.0 ft bls.

3.10.3.2 Soil Samples. Two samples were collected and submitted for chemical and radionuclide analysis during the drilling of 100-BC-5 LFI borehole for monitoring well 199-B3-47. Sample B05XS1 was collected in the 30 to 32.5 ft interval bls. Sample B05XS2 was collected from the 39 to 41.5 ft interval bls.

3.10.3.2.1 Chemical Analyses. Methylene chloride was detected in the 30 to 32.5 ft bls interval in a concentration of 5 μg/kg (Table 3-47). Uses of methylene chloride include solvent extraction, paint removers, solvent degreasing, plastics processing, and aerosol propellant (Sax and Lewis 1987). No other VOCs were detected.

The only semi-volatile organic compound detected was di-n-butyl phthalate. Concentrations of 36 μg/kg and 3000 μg/kg were detected in the 30 to 32.5 ft bls and 39 to 41.5 ft bls intervals, respectively (Table 3-47). Uses of phthalates are discussed in Section 3.6.3.1. The pesticide endrin was detected in the sample from the 30 to 32.5 ft interval (Table 3-47). No PCBs were detected.

No inorganic compounds or metals were detected in concentrations above the Hanford Site background 95% UTL.

3.10.3.2.2 Radionuclide Analyses. The following radionuclides were detected: ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{226}Ra, ^{228}Th, ^{238}U, and ^{241}Am. Table 3-48 summarizes the detected radionuclide concentrations. Gross alpha level ranged from 3.4 pCi/g to 4.5 pCi/g. Gross beta levels ranged from 28 pCi/g to 35 pCi/g. The maximum radionuclide concentration was 1.35 pCi/g of ^{228}Th in the 30 to 32 ft bls interval. All the other radionuclide concentrations were $<$1.2 pCi/g.

3.10.3.2.3 Field Screening. The well site geologist performed field screening for VOCs using an OVM PID. Ambient VOC background during drilling was 0.0 ppm. The field screening action level was 5 ppm. No VOC concentrations above 0 ppm were observed during field screening.

The well site geologist performed field screening for radioactivity using a Ludlum 14C portable scintillation counter and a gross gamma probe. A HPT performed a second field screening of beta-gamma activity using a Geiger-Mueller detector and a

P-11 probe. The site gross gamma background was 2175 cpm. The gross gamma action level was 4350 cpm. No detectable beta-gamma activity was found during drilling. No gross-gamma activity greater than site background was detected by field screening.

3.10.3.2.4 Geophysical Logging. Well 199-B3-47 was logged from the surface to 56 ft bls, three feet less than total borehole depth. The only man-made radionuclide detected was ^{137}Cs. Cesium-137 was detected in the interval from 29 to 43 ft bls. The ^{137}Cs maximum decay activity was < 1 pCi/g. Copies of the logs are in Appendix B.

3.10.4 Conclusions

The 116-B-14 trench was not specifically identified by Dorian and Richards (1978) with a borehole or sampling results. Borehole C in their report, however, appears to be at the edge of the burial trench. It is not known if the borehole is just inside or outside because the exact location of the trench was not surveyed or plotted. The hole was drilled to a depth of 7 m (22 ft). Contamination was negligible at 7 m (22 ft). Based on the sampling results from that borehole, the trench was estimated to contain an inventory of 0.8 Ci for the radionuclides analyzed (Dorian and Richards 1978). The minimal levels of contamination found by Dorian and Richards (1978) are not consistent with the levels of radionuclides present in sludge from the 116-C-5 retention basin, which is considered to be analogous.

Analytical data from well 199-B3-47 indicate possible contamination by methylene chloride and phthalates, and low concentrations of radionuclides. Both methylene chloride and the phthalate compounds are typical laboratory contaminants. Historical records do not indicate that methylene chloride or phthalates were disposed of in the 100-BC-1 Operable Unit (DOE-RL 1992c). The analytical data indicate only minimal contamination may be present in the vadose zone sampled by well 199-B3-47.

Data from analogous sites are not available for site 116-B-13 and 116-B-14.

3.10.5 Groundwater Assessment

The assessment of impact to groundwater posed by the 116-B-13 and 116-B-14 sludge burial trenches is addressed in Section 3.5.4.

3.11 116-B-6A CRIB

This crib, 3.7 m by 2.4 m by 4.6 m deep (12 ft by 8 ft by 15 ft deep), is apparently constructed of wooden timbers with rocky backfill (Campbell et al. 1990). It is covered with 2 m (6 ft) of soil. The crib was operated from 1951 to 1968 and received an estimated 5000 ℓ (1300 gal) of waste from decontamination activities at the 111-B decontamination station.

3.11.1 Geology

The 100-BC-1 LFI did not investigate the 116-B-6A crib. Data are available from the in situ vitrification treatability study performed by PNL (PNL 1992). Three characterization boreholes were drilled at the 116-B-6A site; two were drilled into the 116-B-6A crib, one was drilled about 3 m north of the crib. These boreholes revealed a relatively homogenous matrix consisting of unconsolidated, poorly sorted, sandy gravel to silty sandy gravel, averaging 50-60% gravel, 30-45% sand, and 5-10% mud (silt and clay) (PNL 1992). Moisture content ranged from 4% to 15%.

3.11.2 Soil Samples

3.11.2.1 Chemical Analyses. Chemical analyses performed by PNL (1992) were restricted to metals and inorganic constituents. The concentrations of Cd, Cu, Pb, and Zn were above the Hanford Site background 95% UTL in several sample intervals, as shown below in Table 3-49.

3.11.2.2 Radionuclide Analysis. The samples collected for inorganic and metals analysis were not analyzed for radionuclide content. Radionuclide content was determined using borehole geophysical logging. The results are presented in Section 3.11.2.4.

3.11.2.3 Field Screening. During construction of the boreholes, measurements were taken of radioactivity at 2 ft intervals. These measurements were taken using a Geiger-Mueller instrument. A maximum concentration of 5500 cpm was measured in BH-2 at a depth of six feet. Field measured peaks in radioactivity correspond to the peaks noted in borehole geophysical logging results.

3.11.2.3 Geophysical Logging. Borehole geophysical logs were collected from the BH-1, BH-2, and BH-3. Cesium-137, ^{90}Sr and ^{60}Co were the only reported radionuclides (PNL 1992). The depth intervals and maximum concentrations for these radionuclides were as follows:

- cobalt-60 occurred in BH-1 from 11.5 to 14 ft bls, with a maximum concentration of 122 pCi/g, at 11.5 ft
- cobalt-60 occurred in BH-2 at 12 ft bls with a concentration of 0.58 pCi/g
- cesium-137 occurred in BH-1 from 11.5 to 20 ft bls, with a maximum concentration of 574 pCi/g at 14 ft
- cesium-137 occurred in BH-2 from 4 to 28 ft bls, with a maximum concentration of 3402 pCi/g at 6 ft
- cesium-137 occurred in BH-3 at 20 ft bls, with a concentration of 2.3 pCi/g
- strontium-90 occurred in BH-1 at 14 ft bls, with a concentration of 138 pCi/g.

3.11.3 Conclusions

Radionuclide contamination at the 116-B-6A site was expected in the 15 to 20 ft interval, with the maximum contamination at about 15 ft (Dorian and Richards 1978). The borings constructed for the treatability study (PNL 1992) showed contamination in the 6 to 15 ft interval, with the maximum at six feet. For ^{137}Cs, ^{90}Sr and ^{60}Co, the concentrations reported in PNL (1992) are greater than would be expected by decaying the Dorian and Richards (1978) values from 1976 to 1992.

There are no data available from facilities in the 100 Area analogous to the 116-B-6A crib.

3.11.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B4-7 is downgradient of 116-B-6A. Monitoring well 199-B4-5 is upgradient of 116-B-6A. The groundwater concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H are not appreciably different for downgradient and upgradient samples. The 116-B-6A site does not appear to be contributing radionuclide contaminants to groundwater.

3.12 116-B-6B CRIB

This crib, 4 m by 2.4 m by 2 m deep (12 ft by 8 ft by 6 ft deep), was operated from 1950 to 1953 and received radioactive liquid waste from fuel element decontamination at the 111-B decontamination station. The crib was apparently an unlined excavation, probably filled with gravel, and covered with 2 m (6 ft) of soil after it was abandoned (Ruppert 1953).

3.12.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 116-B-6B crib. It is assumed that the crib is underlain and surrounded by sediments analogous to that found in the 116-B-6A in situ vitrification boreholes, reported in Section 3.11.1.

3.12.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 116-B-6B crib data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

Historical radionuclide concentration data and conclusions for the site are presented in Section 3.12.3.

3.12.3 Conclusions

The only sample obtained during the 1975/1976 radiological investigation appears to have been a surface sample (Dorian and Richards 1978). It is unlikely, however, that a surface sample reflects the contamination within and below the crib, since waste discharges would have occurred below the present soil surface covering the crib structure. Therefore, the inventory given by Dorian and Richards (1978) is suspect.

The operating history of the 116-B-6B crib was similar to the 116-B-6A crib, although the 116-B-6B was used for 3 years and 116-B-6A for 17 years. The volume of waste disposed into the 116-B-6B crib are not known. As a worst case, the levels of contamination found during the treatability test investigation at the 116-B-6A crib can be assumed to be similar to those in the 116-B-6B crib.

3.12.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B4-7 is downgradient of 116-B-6B. Monitoring well 199-B4-5 is upgradient of 116-B-6B. The groundwater concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H are not appreciably different for downgradient and upgradient samples. The 116-B-6B site does not appear to be contributing radionuclide contaminants to groundwater.

3.13 116-B-4 DUMMY DECONTAMINATION FRENCH DRAIN

This french drain, 1.2 m diameter by 6 m deep (4 ft in diameter by 20 ft deep), also known as the dummy decontamination crib, is located east of the B Reactor building. This french drain received an estimated 300,000 ℓ (79,000 gal) of contaminated chromic and nitric acid solutions from the dummy decontamination wash pad at the B Reactor building from 1957 until 1968 (Stenner et al. 1988). The spent acids were neutralized and routed to the french drain via an underground stainless steel pipe, which is included as part of the 116-B-4 unit. Reported quantities of inorganic chemicals disposed of to this french drain include 1000 kg (2200 lb) of sodium dichromate, 1000 kg (2200 lb) of sodium oxalate, and 6000 kg (13,200 lb) of sodium sulfamate (Stenner et al. 1988).

Because the 100-BC-1 LFI did not include a field investigation of the 116-B-4 dummy decontamination french drain data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination

- geophysical borehole logs.

The 100-HR-1 LFI did investigate a site, the 116-H-3 dummy decontamination french drain, that is analogous to the 116-B-4 french drain. The 116-H-3 french drain is 0.9 m diameter x 4.6 m deep (3 ft x 15 ft) received liquid wastes from the decontamination of fuel element spacers (dummies).

3.13.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 116-B-4 dummy decontamination french drain. It is assumed that the 116-B-4 french drain is underlain by silty sandy gravel similar to that encountered in the 116-B-3 LFI vadose borehole.

3.13.2 Soil Samples

3.13.2.1 Chemical Analysis. The laboratory analysis results of samples taken from the 116-H-3 vadose zone borehole showed no inorganic contaminant levels above the 95% UTL. There were no VOC, semi-vol, or pesticide contaminant levels above contract required quantitation limits.

3.13.2.2 Radionuclide Analysis. Seven radionuclides, ^{60}Co, ^{152}Eu, ^{226}Ra, ^{228}Th, $^{233/234}$U, and ^{238}U, were detected above the laboratory's detection limit in the soil samples from the 116-H-3 borehole. All except for ^{152}Eu were less that the contract required detection limit of 0.5 pCi/g. The concentration of ^{152}Eu, 0.54 pCi/g, occurred in a sample collected from the 14.5 to 16.3 ft bls interval. No other occurrences of this radionuclide were detected in samples from the 116-H-3 borehole.

3.13.2.3 Field Screening. No levels of VOCs above the action level (5 ppm above background) were detected during continuous field screening of the 116-H-3 borehole. There also was no radionuclide activity detected above the background level of 75 cpm.

3.13.2.4 Geophysical Borehole Logging. Logging was performed on the 116-H-3 borehole using a spectral gamma-ray system. Small amounts of ^{60}Co, ^{152}Eu, and ^{154}Eu were detected in the borehole. Cobalt-60 was encountered in two intervals in the survey; from the surface to 1 ft (0.3 m) and from 12 ft (3.7 m) to the maximum survey depth of 18 ft (5.5 m) bls. The activity detected was less than 1 pCi/g. Similarly, ^{152}Eu was detected at activity levels of <5 pCi/g in two intervals: from the surface to 1 ft (0.3 m) and from 11 to 18 ft (3.6 to 5.5 m) bls. Europium-154 was detected between 12 and 16 ft (3.7 and 4.9 m) bls. The detected activity was not continuous and was $\leq$1 pCi/g. Cesium-137 was not detected in the borehole.

3.13.3 Conclusions

The 116-B-4 french drain was apparently sampled during the 1976 radiological investigation to a depth of 4.4 m (15 ft). The reported bottom depth of the french drain is

6 m (20 ft). Therefore, the analytical results shown do not reflect contamination present in the bottom of the drain or the soil beneath the drain. The maximum concentration of radionuclides reported in 1978 (Dorian and Richards 1978) for the 116-B-4 site decayed to 1992 are as follows:

Constituent	Concentration (pCi/g)
^{3}H	122
^{60}Co	26
^{90}Sr	3.7
^{134}Cs	0.0002
^{137}Cs	208
^{152}Eu	420
^{154}Eu	45
^{155}Eu	63
^{238}Pu	0.29
^{238}U	0.28
^{239}Pu	8.6

Data from the analogous 116-H-3 facility indicate there is no inorganic or organic contamination at the 116-H-3 dummy decontamination french drain. There are, however, some indications of radionuclide contamination both near the surface and at depth at the 116-H-3 site. One soil sample, the spectral gamma-ray borehole logging, and the historical data from Dorian and Richards (1978) indicate the presence of low levels of radionuclide contamination between approximately 12 and 18 ft (3.7 and 5.5 m) bls. The gamma-ray logs indicate very low levels of radionuclide contamination by ^{60}Co and ^{152}Eu near the surface.

This analogous data is useful for the assessment of the 116-B-4 site. It is assumed that inorganic and organic contaminants are not present at the 116-B-4 french drain, and that the types of radionuclides that may be present at the 116-B-4 site are similar to those found at the 116-H-3 french drain. The estimated 1978 inventory of radionuclides in the 116-B-4 site and the 116-H-3 site were 2.0 Ci and 0.07 Ci, respectively (DOE-RL 1992a, and Dorian and Richards 1978). Because the 116-B-4 estimated inventory was 28 times that of 116-H-3, radionuclide contamination may be expected to be considerably greater at 116-B-4 than was found in 116-H-3 samples.

3.13.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B4-9 is located downgradient of 116-B-4, although offset about some 70 m to the northeast, and downgradient of site 116-B-2. Monitoring well 199-B4-4 is upgradient of 116-B-4. Because only these two monitoring wells are available there is uncertainty in the assessment of groundwater impact from site 116-B-4. The concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H are not appreciably different between these two wells. Although the 116-B-4 site contains ^{90}Sr, and it is likely to have received effluent containing ^{99}Tc, the site does not appear to be a current source of groundwater contamination.

3.14 116-B-9 FRENCH DRAIN

This disposal unit, 1.2 m in diameter by 0.9 m deep (4 ft diameter by 3 ft deep), is located west of the 132-B-1 ^{3}H recovery facility. It was used from 1952 to 1954 to receive an estimated 40,000 ℓ (10,600 gal) of waste water from what is described as the P-10 storage building drain (Clukey 1956, Stenner et al. 1988). The nature of the activities in the building is unknown (DOE-RL 1992a). Since the P-10 project involved ^{3}H production, ^{3}H may be a potential contaminant. More definitive information on potential contamination is unavailable. No sampling has been performed on this unit.

3.14.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 116-B-9 french drain. It is assumed that the french drain is underlain by sands and gravels similar to that encountered in the 116-B-5 LFI vadose borehole.

3.14.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 116-B-9 french drain data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.14.3 Conclusions

No historical data for the 116-B-9 french drain are available. It was not sampled during the 1976 radiological investigation (Dorian and Richards 1978).

There are no facilities in the 100 Area analogous to the 116-B-9 french drain.

3.14.4 Groundwater Assessment

The current impact of the 116-B-9 site on groundwater cannot be assessed since data are not available from monitoring wells or 100-BC-1 LFI analyses.

3.15 116-B-10 DRY WELL

This dry well was constructed as a 0.9 m (3 ft) diameter tile-lined well on a concrete slab, 2 m (7 ft) deep, overlain with a manhole cover. Liquid waste apparently overflowed to or from a 15 cm (6 in) process sewer line 0.9 m (3 ft) from the bottom slab. The method by which this system operated is unclear. The well received an estimated 5 million ℓ (1.3 million gal) of liquid decontamination wastes from the 132-B-1 building from 1950 to 1968 (Stenner et al. 1988). Based on the knowledge that ^{3}H recovery activities were conducted at the building, ^{3}H is a potential contaminant. Other potential contaminants include Cr and nitrate, typically found in decontamination solutions. No sampling has been performed on this unit.

3.15.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 116-B-10 dry well. It is assumed that the dry well is underlain by sands and gravels similar to that encountered in the 116-B-3 and 116-B-5 LFI vadose boreholes.

3.15.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 116-B-10 dry well data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.15.3 Conclusions

No historical sampling data for the 116-B-10 dry well are available. It was not sampled during the 1976 radiological investigation (Dorian and Richards 1978).

There are no facilities in the 100 Area analogous to the 116-B-10 dry well.

3.15.4 Groundwater Assessment

The current impact of the 116-B-10 site on groundwater cannot be assessed since data are not available from monitoring wells or 100-BC-1 LFI analyses.

3.16 116-B-12 CRIB

This crib, 3 m x 3 m x 3 m deep (10 ft x 10 ft by 10 ft deep), received drainage from the confinement system seal pits in the 132-B-4 air filtration ventilation building. Waste volume is unknown. Potential contaminants include ^{3}H, ^{14}C, and other potentially gaseous radionuclides.

The 100-BC-1 LFI did not include a field investigation of the 116-B-12 crib. The 100-DR-1 LFI did investigate an analogous site, the 116-D-9 crib. This 3 m x 3 m x 3 m (10 ft x 10 ft x 10 ft) structure received liquid wastes associated with the 117-D building seal pits confinement system. Because the 116-B-12 was not investigated during the 100-BC-1 LFI site-specific data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.16.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 116-B-12 crib. It is assumed that the crib is underlain by sands and gravels similar to that encountered in the 116-B-2 LFI vadose borehole.

3.16.2 Soil Samples

3.16.2.1 Chemical Analyses. Acetone, a typical laboratory analytical contaminant was found in two samples from the 116-D-9 investigation.

No semi-volatile organic compounds, pesticides or PCBs were detected in the 100-DR-1 LFI; equivalent conditions are anticipated for the 116-B-12 crib.

No metals or other inorganic compounds were detected at concentrations above the Hanford Site background 95% UTL in the 116-D-9 crib. The same conditions are expected for the 116-B-12 crib.

3.16.2.2 Radionuclide Analyses. Radionuclide analyses of samples collected from a boring at the 116-D-9 analogous facility detected ^{14}C, ^{40}K, ^{90}Sr, ^{226}Ra, ^{228}Th, ^{238}U, and ^{241}Am. The maximum concentration of ^{90}Sr was 2.9 pCi/g. Table 3-50 shows the results of the 116-D-9 analyses.

3.16.2.3 Field Screening. No intrusive field investigations were conducted at this site; no VOCs were found in the analogous 116-D-9 crib. Likewise, no radionuclides were detected during field screening of soils at the 116-D-9 crib. Similar conditions are likely at the 116-B-12 crib.

3.16.2.4 Geophysical Logging. No geophysical logs were run at the 116-D-9 site.

3.16.3 Conclusions

No historical sampling data for the 116-B-12 crib are available. It was not sampled during the 1976 radiological investigation (Dorian and Richards 1978). Analogous data from the 116-D-9 crib indicated the presence of only low levels of radionuclide contamination. This was also the case for the 116-H-9 site, another analogous facility that was examined during the 100-HR-1 LFI. The detected radionuclides in 116-H-9 samples, ^{137}Cs, ^{152}Eu, ^{226}Ra, ^{228}Th, ^{232}Th, and ^{238}U, were not identical to those at 116-D-9 (Table 3-50). The 116-H-9 concentrations were all less than 1.3 pCi/g. Analyses of 116-H-9 samples revealed no organic compounds, and no inorganic contaminants. The data from these two sites are generally consistent for non-radiological constituents. There were two detections of acetone at 116-D-9 but no detections in 116-H-9 samples. Acetone does not appear to be facility-specific, and is not expected at the 116-B-12 site. The data indicate the uncertainty that the use of data from analogous sites entails.

If this analyte proves to be facility- specific, it is of potential concern for the 100-BC-1 Operable Unit.

3.16.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B4-4 is located downgradient of 116-B-12. Monitoring well 199-B4-7 is upgradient of 116-B-12. The ^{90}Sr concentrations in groundwater from well 199-B4-4 were three to six times higher than the samples from well 199-B4-7. The concentrations of ^{99}Tc and ^{3}H are not appreciably different between these two wells. The 116-B-12 site appears to be a current source of groundwater contamination, although the 132-B-4 and 132-B-5 facilities could be contributing contaminants as well.

3.17 118-B-5 BALL 3X BURIAL GROUND

This burial ground, 15 m by 15 m by 6 m deep (50 ft by 50 ft by 20 ft deep), contains irradiated reactor wastes such as old thimbles, step-plugs, and other components. These were removed from the B Reactor during the Ball 3X Project shutdown in January 1953, when the reactor was converted from a liquid boron safety system to a solid ball 3X system using nickel-plated boron steel and carbon steel balls. The burial trench was backfilled with about 1.5 m (5 ft) of clean soil overlying the buried materials (Heid 1956).

3.17.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 118-B-5 burial ground. It is assumed that the burial ground is underlain by sands and gravels similar to that encountered in the 116-B-6A borehole (PNL 1992).

3.17.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 118-B-5 burial ground data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.17.3 Conclusions

No historical sampling data for the 118-B-5 burial ground are available. It was not sampled during the 1976 radiological investigation (Dorian and Richards 1978). Typical contaminants that are generally associated with reactor hardware are ^{60}Co and ^{63}Ni.

3.17.4 Groundwater Assessment

The burial ground is not impacting groundwater. Contaminants thought to be associated with the burial ground, such as ^{60}Co, were not detected in downgradient monitoring well 199-B4-4, or in any monitoring wells.

3.18 118-B-7 SOLID WASTE BURIAL GROUND

The 118-B-7 solid waste burial ground, 2 m by 2 m by 2 m deep (8 ft by 8 ft by 8 ft deep), received small amounts of waste from the 111-B facility. Most of the waste consisted of decontamination materials and associated equipment. Small amounts of reactor hardware may be present. Typical contaminants may include ^{60}Co and ^{63}Ni. No sampling has been performed.

3.18.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 118-B-7 burial ground. It is assumed that the burial ground is underlain by sands and gravels similar to that encountered in the 116-B-6A borehole (PNL 1992).

3.18.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 118-B-7 burial ground data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.18.3 Conclusions

No historical sampling data for the 118-B-7 burial ground are available. It was not sampled during the 1976 radiological investigation (Dorian and Richards 1978). Typical contaminants that are generally associated with reactor hardware are ^{60}Co and ^{63}Ni.

3.18.4 Groundwater Assessment

The burial ground is not impacting groundwater. Contaminants thought to be associated with the burial ground, such as ^{60}Co, were not detected in downgradient monitoring well 199-B4-7, or in any monitoring wells.

3.19 132-B-4/5 FILTER BUILDING, GAS RECIRCULATION BUILDING AND TUNNELS

The 132-B-4 filter building was a concrete structure 18 m x 12 m x 11 m (59 x 39 x 36 ft) high with an inlet tunnel 34 m (112 ft) long and an exhaust tunnel 24 m (79 ft) long. The building received exhaust fan discharge through an inlet duct from the B Reactor building and discharged filtered air through a duct and out the 132-B-2 exhaust stack. United Nuclear Industries personnel collected smear samples from the filter cells and inlet tunnel, analyzed the smear samples for radionuclides, and reported the results in 1978 (Dorian and Richards 1978). The radionuclides ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{154}Eu were present in scale from the drains under the A and B filter frames (Dorian and Richards 1978). Samples collected from the inlet tunnel contained ^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{238}Pu, and $^{239/240}$Pu. The data were reported as pCi/sample, each sample consisting of a standard smear collected over an area of 100 cm^{2}. The data are not directly comparable to concentrations expressed in pCi/g units. Radionuclides identified during a 1987 analysis of paint samples were ^{3}H, ^{14}C, ^{90}Sr, ^{137}Cs, and ^{239}Pu (Issaacson 1987). The site was decommissioned in 1988. The building and ducts were excavated and demolished in situ. The contaminated rubble was buried at least 1 m (3.2 ft) below grade, except for rubble from the seal pits, which was buried under at least 5 m (16 ft) of clean fill (Stenner et al. 1988).

The 132-B-5 gas recirculation building was a concrete building measuring 51 x 22 to 30 x 9.5 m (167 x 72 to 98 x 31 ft) high. United Nuclear Industries personnel collected smear samples from the floors of the gas piping tunnel and gas dryer room number 5, analyzed the smear samples for radionuclides, and reported the results in 1978 (Dorian and Richards 1978). The floor smear samples from the tunnel and the room contained ^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{238}Pu, and $^{239/240}$Pu (Dorian and Richards 1978). Europium-155 was also found in a floor smear sample from dryer room number 5. The data were reported as pCi/sample, each sample consisting of a standard smear collected over an area of 100 cm^{2}. The data are not directly comparable to concentrations expressed in pCi/g units. Stenner et al. (1988) identified the radionuclides ^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, and ^{239}Pu at the facility. Only the concentration of ^{90}Sr, 1,030 $\pm$ 290 pCi/g from pulverized concrete samples, has been specified to date (Beckstrom 1989). The building was demolished in situ by placing building pieces in the basement and tunnels (Stenner et al. 1988).

3.19.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 132-B-4/5 sites. It is assumed that the site is underlain by sands and gravels similar to that encountered in the 116-B-6A borehole (PNL 1992).

3.19.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 132-B-4/5 sites ground data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.19.3 Conclusions

The historical data (Dorian and Richards 1978) and the 1988 and 1989 sampling data for the 132-B-4 and 132-B-5 sites are available but incomplete; concentration information, expressed in pCi/g, are absent for all radionuclides except for ^{90}Sr.

There are no data available from facilities in the 100 Area analogous to the 132-B-4 and 132-B-5 sites.

3.19.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B4-4 is located downgradient of 132-B-4 and 132-B-5. Monitoring well 199-B4-7 is upgradient of 116-B-12. The ^{90}Sr concentrations in groundwater from well 199-B4-4 were three to six times higher than the samples from well 199-B4-7. The concentrations of ^{99}Tc and ^{3}H are not appreciably different between these two wells. Although the 132-B-4 and

132-B-5 sites may be contributing contaminants to groundwater, a more likely source is the 116-B-12 site. The available monitoring wells are not sufficient to resolve the uncertainty.

3.20 118-B-10 SOLID WASTE BURIAL GROUND

A mound approximately 24 m (80 ft) south of the B Reactor building transfer bay was recently identified as a potential burial ground. The size of this burial ground and the type of waste it may contain are unknown. It is suspected that it may contain irradiated reactor components.

3.20.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 118-B-10 burial ground. It is assumed that the burial ground is underlain by sands and gravels similar to that encountered in the 116-B-3 and 116-B-5 vadose borehole.

3.20.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 118-B-10 solid waste burial ground data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.20.3 Conclusions

No historical sampling data for the 118-B-10 burial ground are available. It was not sampled during the 1976 radiological investigation (Dorian and Richards 1978). Typical contaminants that are generally associated with reactor hardware are ^{60}Co and ^{63}Ni.

3.20.4 Groundwater Assessment

The burial ground is not impacting groundwater. Contaminants thought to be associated with the burial ground, such as ^{60}Co, were not detected downgradient monitoring wells 199-B4-4, 199-B4-9, or in any other monitoring wells.

3.21 128-B-3 BURN PIT

The 128-B-3 site was used to burn office waste, waste paints, and solvents and also received coal ash and demolition waste. The specific dates of operation are not known so it is assumed to be from 1943 to 1968. The contents in the site are not known. This unit has not been sampled for hazardous wastes. No other information is available for the 128-B-3 site.

3.21.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 128-B-3 site. There are no nearby LFI vadose boreholes to provide site-specific geologic data.

3.21.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 128-B-3 site data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.21.3 Conclusions

No historical sampling data for the 128-B-3 site are available. It was not sampled during the 1976 radiological investigation (Dorian and Richards 1978).

There are no data from facilities in the 100 Area analogous to the 128-B-3 burn pit.

3.21.4 Groundwater Assessment

The available monitoring wells are not sufficient to allow an assessment of current impact to groundwater posed by the 128-B-3 site.

3.22 126-B-2 CLEAR WELLS

The 126-B-2 clear wells were part of the B Reactor cooling water treatment system. Filtered water was pumped from the 183-B building to the 38 million ℓ (10 million gal) clear wells then to storage tanks and from the storage tanks to the B Reactor. The pump room associated with the clear wells is the only part of the site containing waste. The waste is demolition debris from the above ground portion of the pump room. The exact operational period of the clear wells is not known so it is assumed to be from 1943 to 1968.

This unit has not been sampled for hazardous wastes. No other information is available for the 126-B-2 site.

3.22.1 Geology

The 100-BC-1 LFI did not include a field investigation of the 126-B-2 site. There are no nearby LFI vadose boreholes to provide site-specific geologic data.

3.22.2 LFI Data

Because the 100-BC-1 LFI did not include a field investigation of the 126-B-2 site data are not available for the following:

- soil concentrations of organic, inorganic and metallic constituents
- physical properties of the soils
- field screening for VOC and radiological contamination
- geophysical borehole logs.

3.22.3 Conclusions

No historical sampling data for the 126-B-2 site are available. It was not sampled during the 1976 radiological investigation (Dorian and Richards 1978).

There are no data from facilities in the 100 Area analogous to the 126-B-2 clear wells.

3.22.4 Groundwater Assessment

Figures 3-4, 3-5, and 3-6 present the ^{90}Sr, ^{99}Tc, and ^{3}H concentrations in 100-BC-5 groundwater from July and October of 1992 sampling rounds. Monitoring well 199-B5-1 is downgradient of 126-B-2. The ^{90}Sr and ^{3}H concentrations in groundwater from well 199-B5-1 are not elevated relative to other wells in the 100-BC-5 Operable Unit. The concentrations of ^{99}Tc in samples from well 199-B5-1 are not elevated relative to upgradient wells 199-B4-4, 199-B4-5, and 199-B4-7. These wells are upgradient, as the September 1992 water table elevations indicate a northwest component to the groundwater flow. Monitoring well data indicate that the 126-B-2 site is not impacting groundwater.

3.23 NON-WASTE SITE SOIL SAMPLES

Two surface soil samples (B05XZ4 and B05XZ5) were collected at a location about 0.1 mi east of the railroad crossing on Route 1 (B Avenue) to provide data for the local background concentrations of inorganic and organic constituents, and radionuclides

(Figure 3-4). Subsequent to their collection and analysis the unit managers decided not to utilize the data to represent local background. The unit managers agreed that the Hanford Site background 95% UTL values were more appropriate as inorganic background concentrations, and that organic and radionuclide background values are not currently available. The data from the two samples may be useful at a later date. Table 3-51 presents the sample intervals, analytical laboratory, analyses performed, and the environmental data transmission numbers associated with each sample.

3.23.1 Soil Samples

3.23.1.1 Chemical Analysis. The VOCs methylene chloride, chloroform, and toluene were detected in the two samples in concentrations less than the CRQL of 10 μg/kg. No other VOCs were detected in the soil samples.

No semi-volatile compounds were detected in the soil samples.

No pesticides or PCBs were detected.

Metals and inorganic compounds, e.g., nitrate, sulfate, fluoride are present in concentrations significantly less than the Hanford Site background 95% UTL.

3.23.1.2 Radionuclide Analysis. Radioactive isotopes of americium, plutonium, potassium, radium, strontium, thorium, and uranium were detected in the soil samples. The concentrations reported are very similar to those reported for silica sand equipment blank B05XY7 (Table 3-52).

3.23.2 Conclusions

Toluene and methylene chloride are typical laboratory contaminants. The presence of these compounds and chloroform are highly suspect given the site location, absence of nearby waste sites, and the sandy porous nature of Hanford soils. The persistence of these volatile compounds in the shallow soil is not credible. Toluene was detected in many laboratory blank samples (WHC 1992c). Methylene chloride has also been detected in a silica sand equipment blank (sample B05XY7) at a concentration of 2 ppb (WHC 1992c).

No semi-vol, pesticide, or PCB compounds were detected. The concentrations of metals and inorganic compounds, e.g., nitrate, sulfate, fluoride are significantly less than the Hanford Site inorganic soil background 95% UTL.

The similarity of radionuclide concentrations found in the soil samples and the silica sand equipment blank (sample B05XY7) suggests that the anthropogenic radionuclides detected do not represent contamination in the soil samples.

3.24 ELECTRICAL FACILITIES

Electrical facilities in the 100-BC-1 Operable Unit were ranked in the 100-BC-1 Work Plan (DOE-RL 1992a) as low-priority facilities. However, the potential for contamination of the soil by PCBs at the facilities was recognized and sampling of surface soil at these facilities was performed to assess the scope of PCB contamination present. Locations for sampling were selected after a literature search and site walk-over were performed. The 13 sampling locations are shown on Figure 3-12. Visual evidence of contamination was the criteria used to identify soil for collection.

3.24.1 Soil Samples

Nineteen samples were collected for analysis during the electrical facility source sampling activity. They were analyzed for PCBs. Table 3-53 presents the sample numbers, sample locations, analysis performed, and the environmental data transmission number associated with each sample.

3.24.2 Chemical Analysis

The PCBs Arochlor-1254 or Arochlor-1260 were identified in 12 of the 19 samples. Arochlor-1254 was found in 11 samples, with detected concentrations ranging from 21 μg/kg to 6400 μg/kg. One sample contained 340 μg/kg of Arochlor-1260. Table 3-54 presents the PCB concentrations found for all the samples.

3.24.3 Conclusions

The analytical results indicate that PCB contamination should be considered when the 100-BC-1 and 100-BC-2 electrical facilities undergo remediation. Because these facilities are not considered high-priority sites for remediation (DOE-RL 1992a) they have not been included in the QRA, and are not considered in the IRM path. The data for these facilities are presented here because the sampling and analyses were associated with the 100-BC-1 scope of work.

3.25 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, requires that fund-financed, enforcement, and federal facility remedial actions comply with ARARs of federal environmental laws and more stringent, promulgated state environmental or facility siting laws.

Comprehensive Environmental Response Compensation and Liability Act defines applicable requirements as those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

In addition to ARARs, CERCLA also provides for the consideration of to-be-considered (TBC) guidance, non-promulgated advisories or guidance documents issued by federal or state governments that do not have the status of potential ARARs but which may be considered in determining necessary levels of protection of health or the environment.

Applicable or relevant and appropriate requirements may be further subdivided into the following categories:

- *Chemical-specific requirements* - health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values. If a chemical has more than one such requirement that is ARAR, compliance should generally be with the most stringent requirement.

- *Location-specific requirements* - restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations, such as wetlands or historic places.

- *Action-specific requirements* - technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

Potential chemical- and location-specific ARARs are defined during the field investigation portion of the CERCLA process and refined in the feasibility study and proposed plan. Action-specific ARARs are generally defined during the phase I and II feasibility study and refined in detailed analysis and the proposed plan. Potential ARARs and TBCs in all categories are defined in the *100 Area Feasibility Study, Phases 1 and 2* (DOE-RL 1992e). For purposes of this LFI, only the chemical- and location-specific ARARs are discussed. Chemical- and location-specific ARARs are used in the LFI report as screening criteria for the evaluation of high-priority sites as IRM candidates. This use of ARARs is not intended to set cleanup standards for the high-priority sites. Chemical- and location-specific ARARs are presented in Tables 3-53 through 3-58.

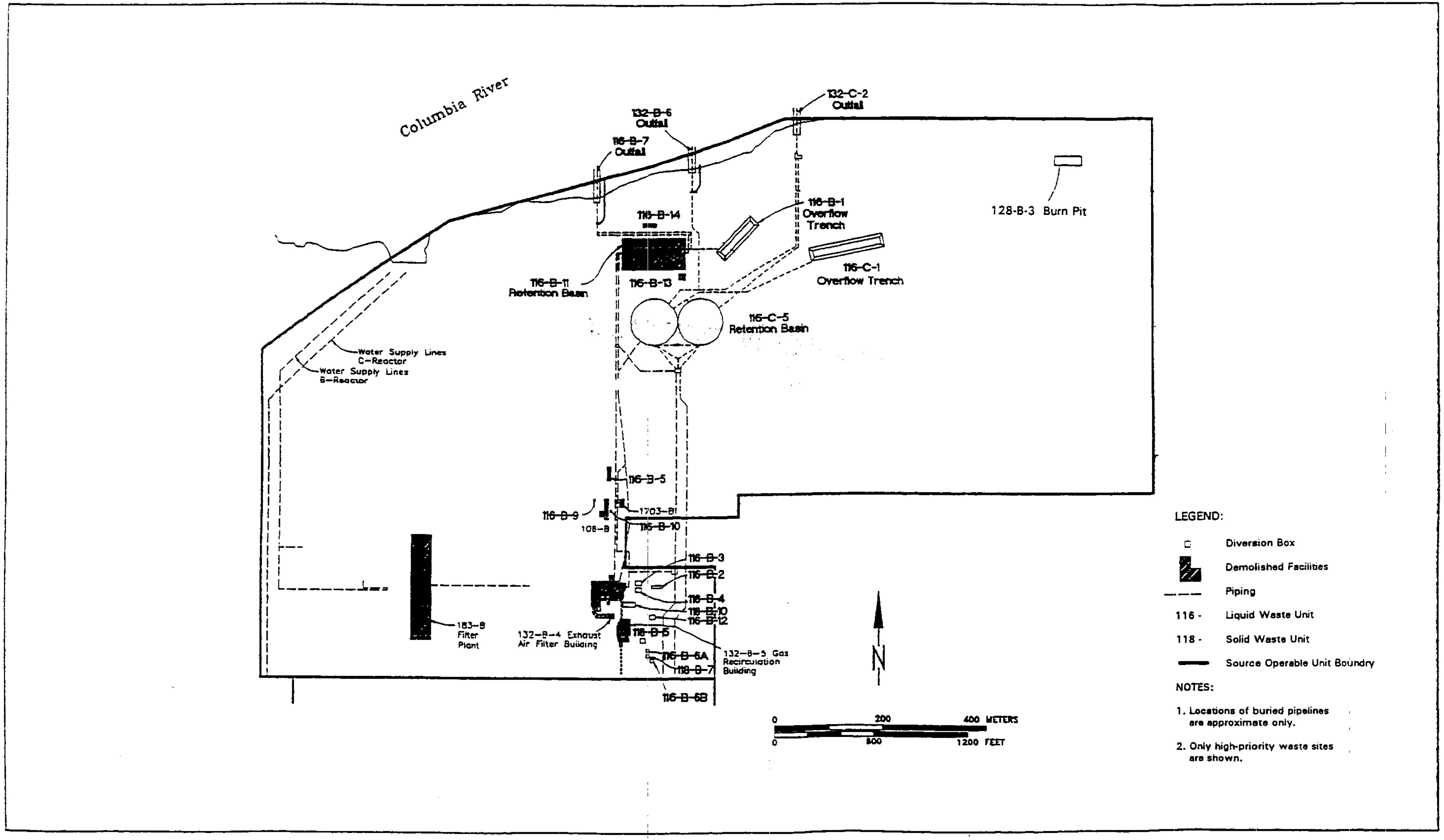
Chemical-specific ARARs for soils are limited to those levels for hazardous constituents prescribed in the state's Model Toxics Control Act (MTCA). Currently, MTCA has not defined levels for radionuclides. Additional soil limits are presented in Subpart S of

RCRA for hazardous constituents and in DOE Order 5400.5 for radionuclides. These are considered TBCs for the 100 Area operable units. Potential chemical-specific ARARs for air emissions are also identified for the 100 Area; however, these tend to also be based on specific actions which have a tendency to increase releases to the air. Therefore, these are more appropriately addressed in the focused feasibility study. Potential chemical-specific ARARs are listed in Table 3-55 and 3-56; TBCs are included in Table 3-57.

Potential location-specific ARARs are identified for the 100 Area because of the presence of threatened or endangered species and archaeological resources. In addition, potential location-specific ARARs based on possible impacts to wetlands and floodplains are included. These are described in Tables 3-58 and 3-59; TBCs are in Table 3-60.

This discussion of potential ARARs is intended to be a refinement of ARARs presented in the work plan. Additional evaluation of potential ARARs will be done in the FS phase. Final ARARs will be determined in the ROD.

Figure 3-1 Map of the 100-BC-1 Operable Unit High-priority Sites as they Existed During Active Operations



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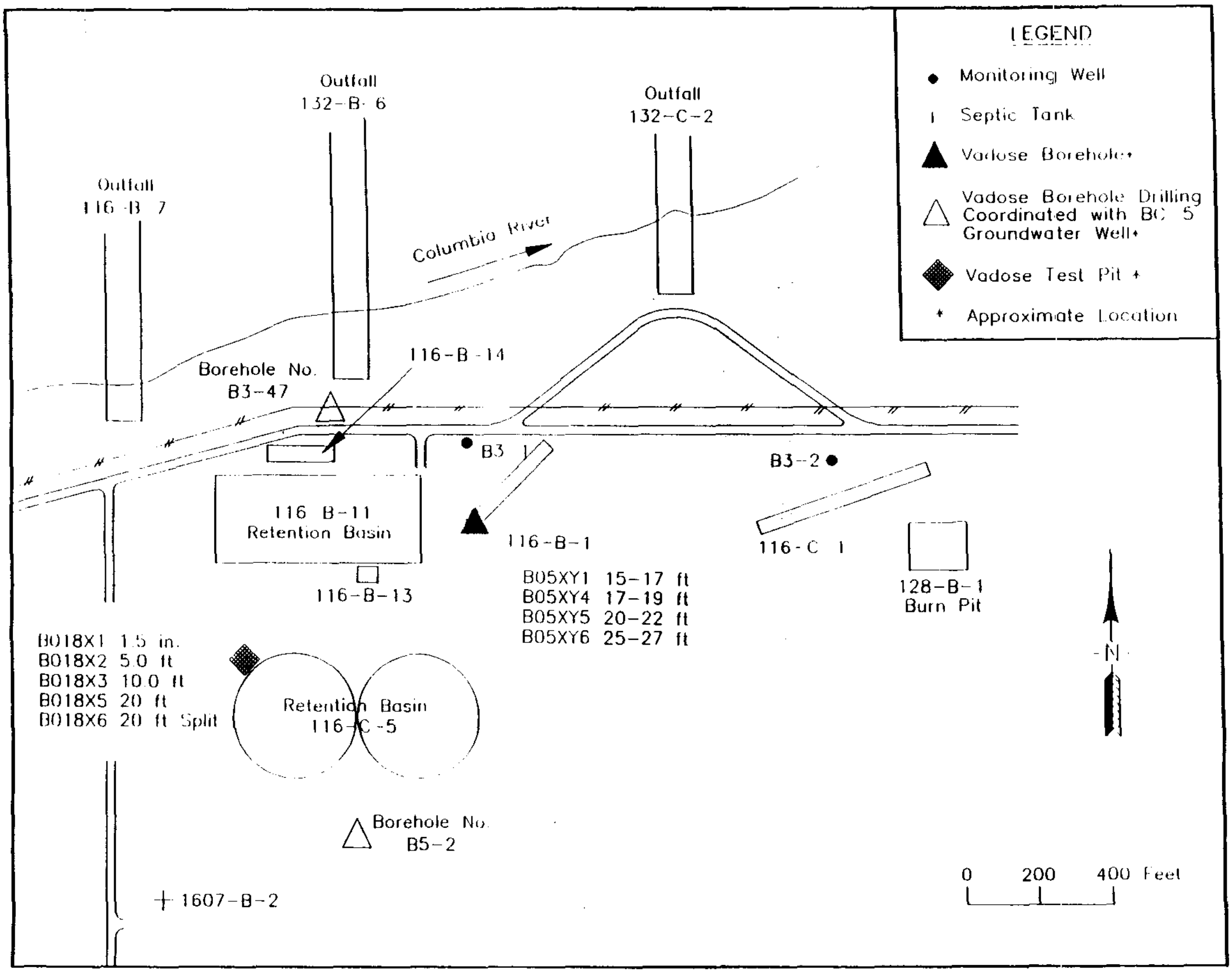

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Figure 3-2 Location of LFI 116-B-1 Borehole and the 116-C-5 Vadose Test Pit and Nearby 100-BC-1 Operable Unit High-priority Sites

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Figure 3-3 Comparison of the 116-B-1 LFI Borehole Data and Historical Data

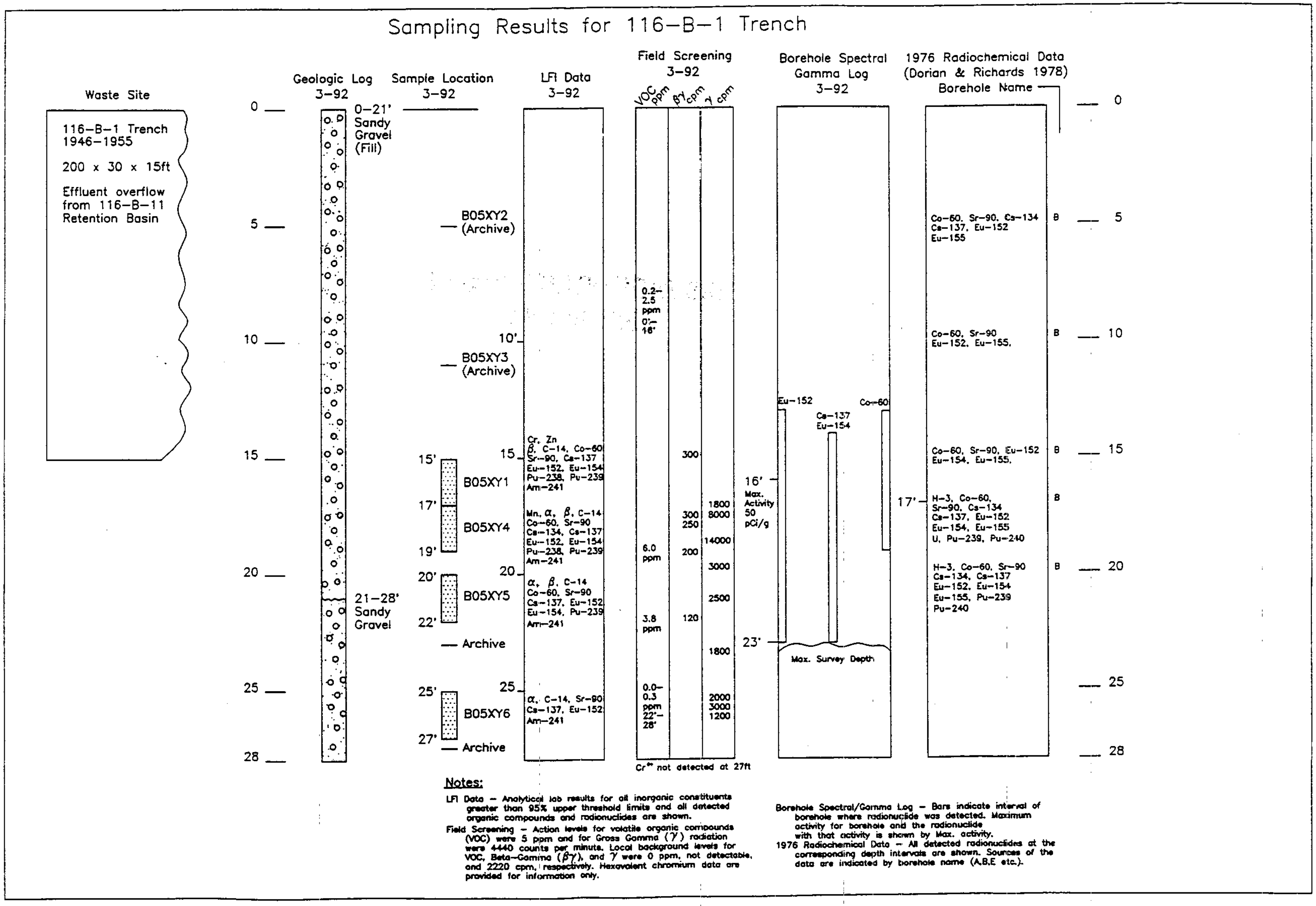

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Figure 3-4 Strontium-90 Groundwater Concentrations in July and October 1992 Sampled by Monitoring Wells in Upper Unconfined Aquifer and by Monitoring Well B2-12 in Upper Confined Aquifer as part of the 100-BC-5 Limited Field Investigation

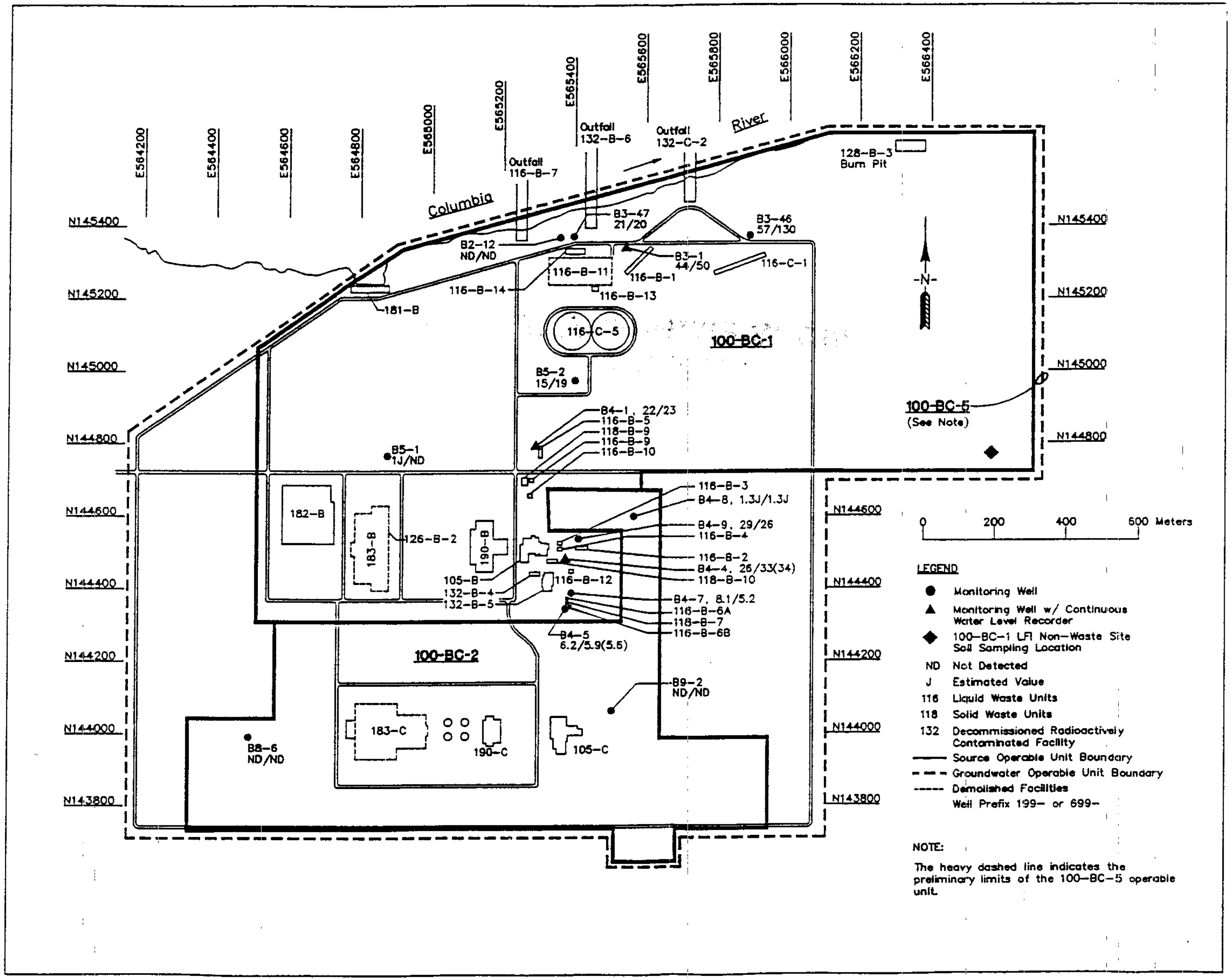

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Figure 3-5 Technetium-99 Groundwater Concentration in July and October 1992 Sampled by Monitoring Well in Upper Unconfined Aquifer and by Monitoring Well B2-12 in Upper Confined Aquifer as part of the 100-BC-5 Limited Field Investigatio

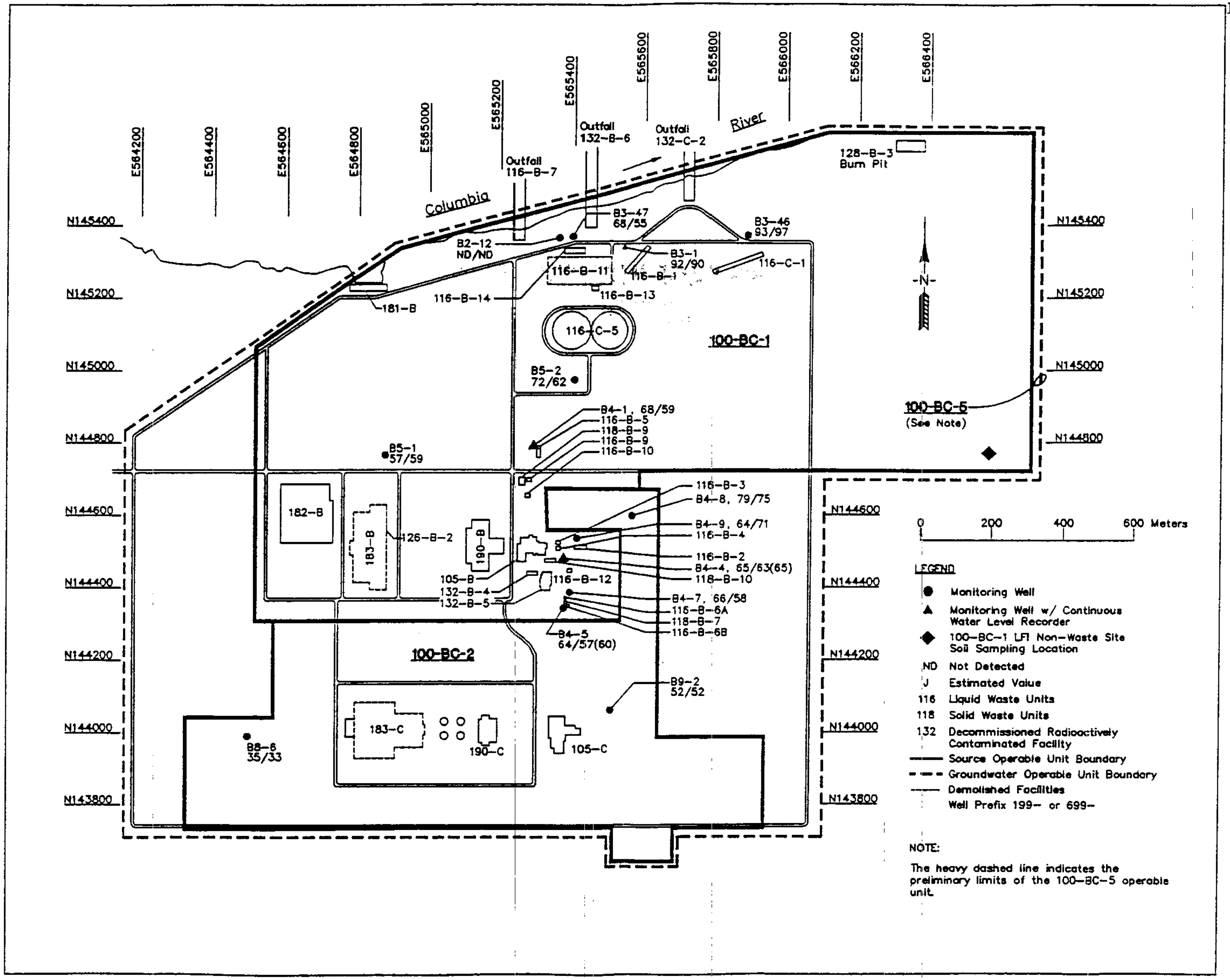

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Figure 3-6 Tritium Groundwater Concentrations in July and October 1992 Sampled by Monitoring Wells in Upper Unconfined Aquifer and by Monitoring Well B2-13 in Upper Confined Aquifer as part of the 100-BC-5 Limited Field Investigation

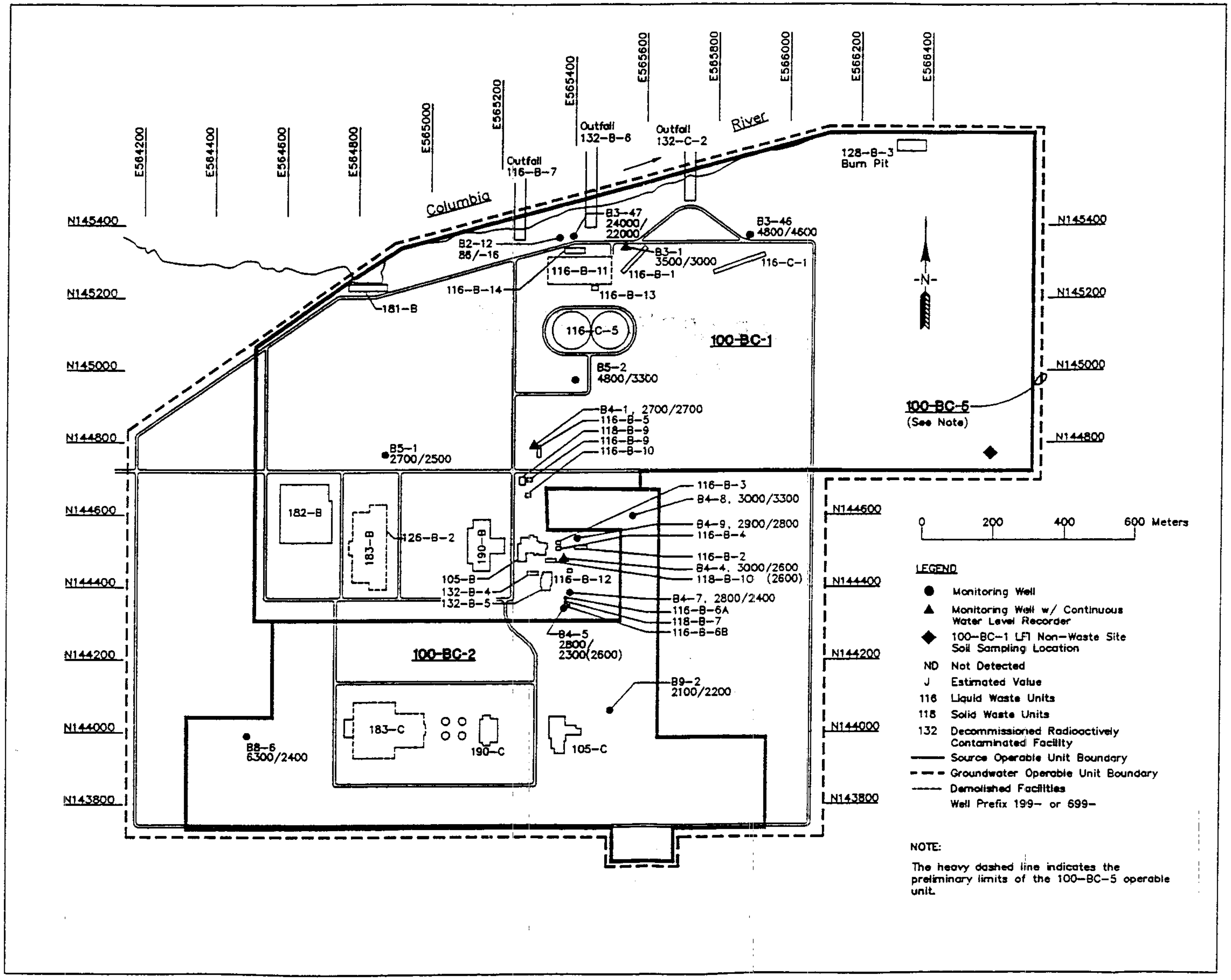

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Figure 3-7 Location of LFI Boreholes 116-B-2, 116-B-3, 116-B-5 and Nearby 100-BC-1 Operable Unit High-priority Sites

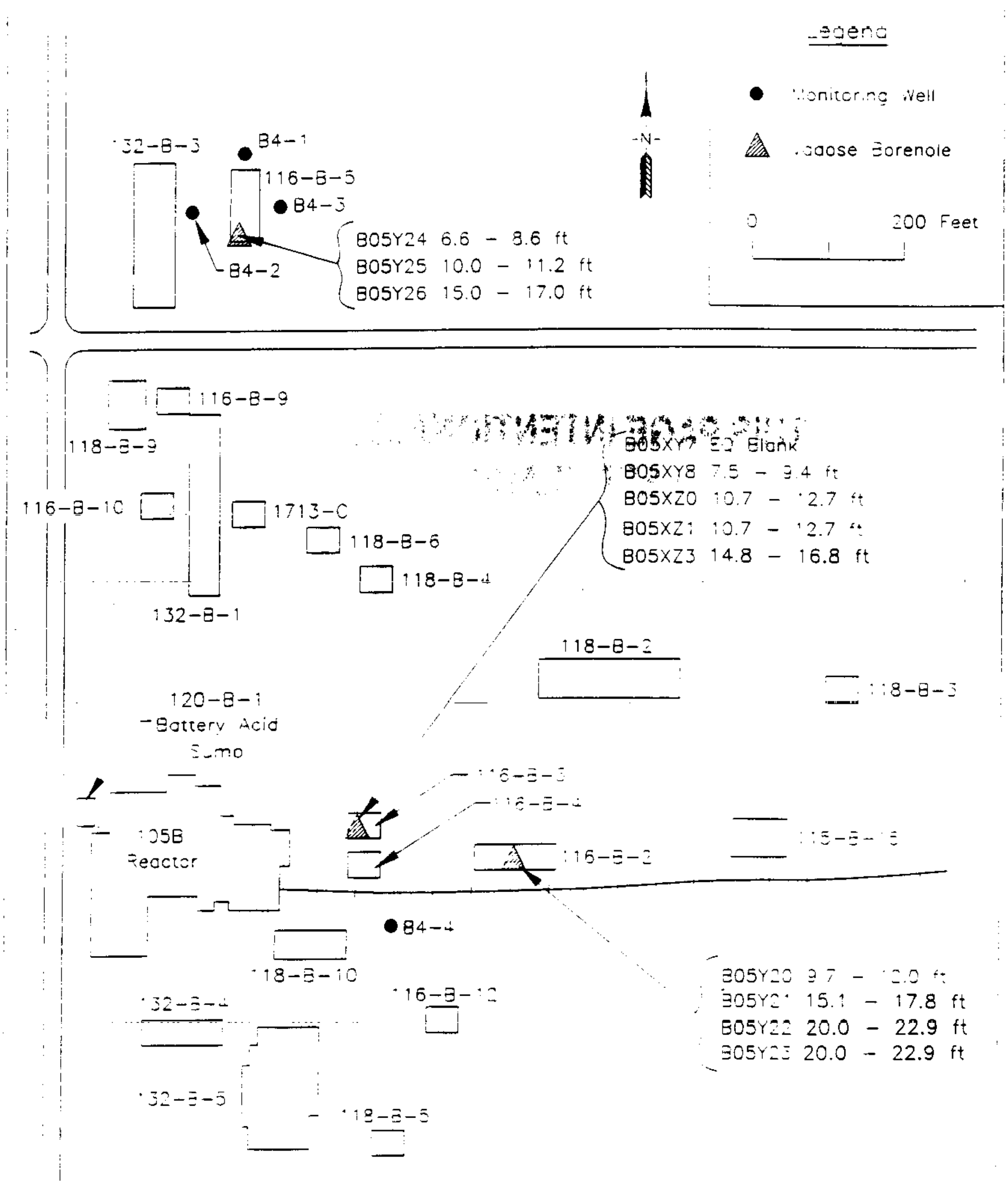

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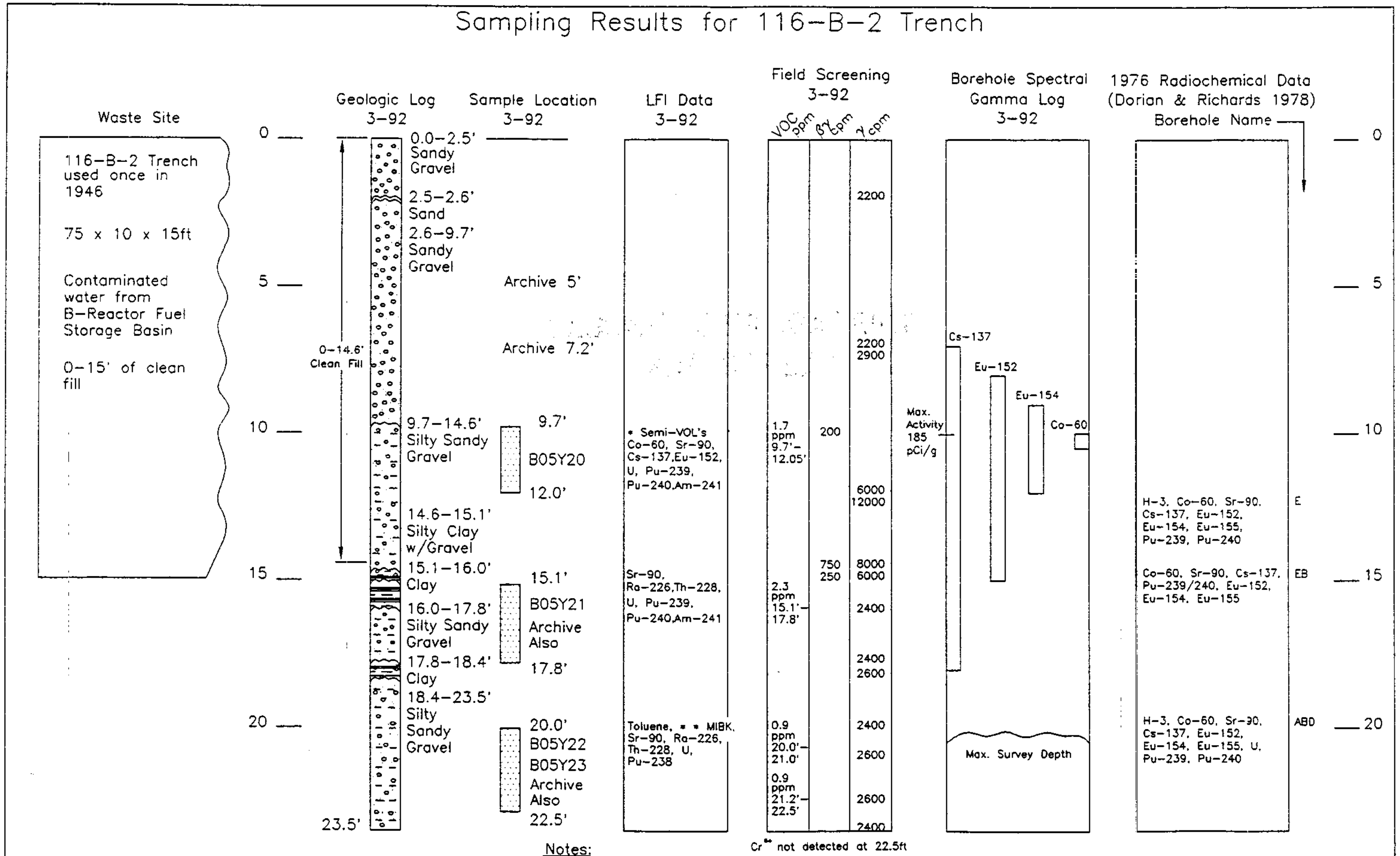
Figure 3-8 Comparison of the 116-B-2 LFI Borehole Data and Historical Data



Notes:

LFI Data - Analytical lab results for all inorganic constituents greater than 95% upper threshold limits and all detected organic compounds and radionuclides are shown.

Field Screening - Action levels for volatile organic compounds (VOC) were 5 ppm and for Gross Gamma (γ) radiation were 4700 counts per minute. Local background levels for VOC, Beta-Gamma ($\beta\gamma$), and γ were 0 ppm, not detectable, and 2350 cpm, respectively. Hexavalent chromium data are provided for information only.

Borehole Spectral Gamma Log - Bars indicate interval of borehole where radionuclide was detected. Maximum activity for borehole and the radionuclide associated with that activity is shown by Max. Activity.

1976 Radiochemical Data - All detected radionuclides at the corresponding depth intervals are shown. Sources of the data are indicated by borehole name (A,B,E etc.). data are indicated by borehole name (A,B,E etc.).

* = N-nitrosodiphenylamine, pyrene.

* * MIBK = 4-Methyl-2-pentanone

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Figure 3-9 Summary Diagram of the 116-B-3 LFI Borehole Data

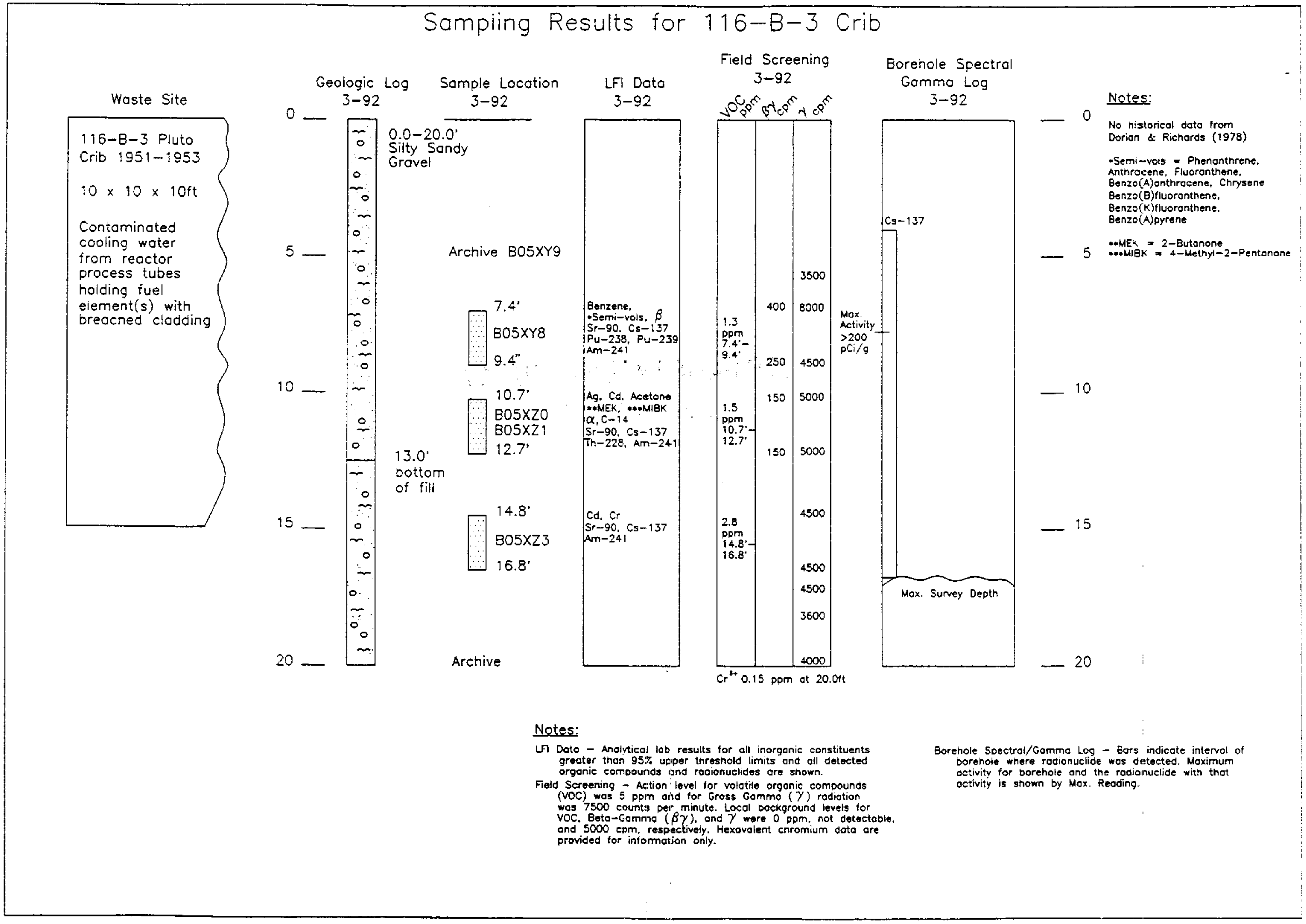

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Figure 3-10 Comparison of the 116-B-5 LFI Borehole Data and Historical Data

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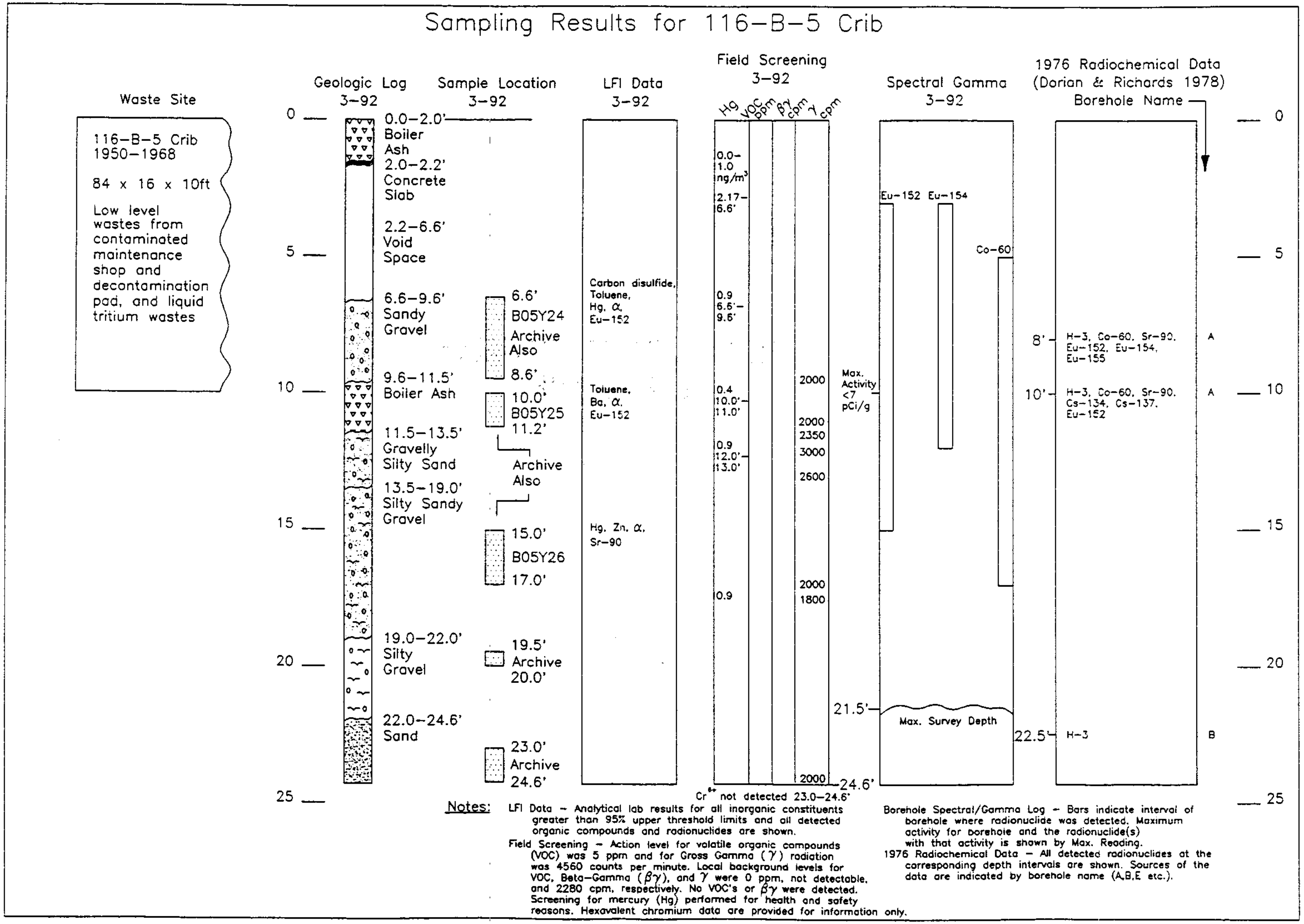

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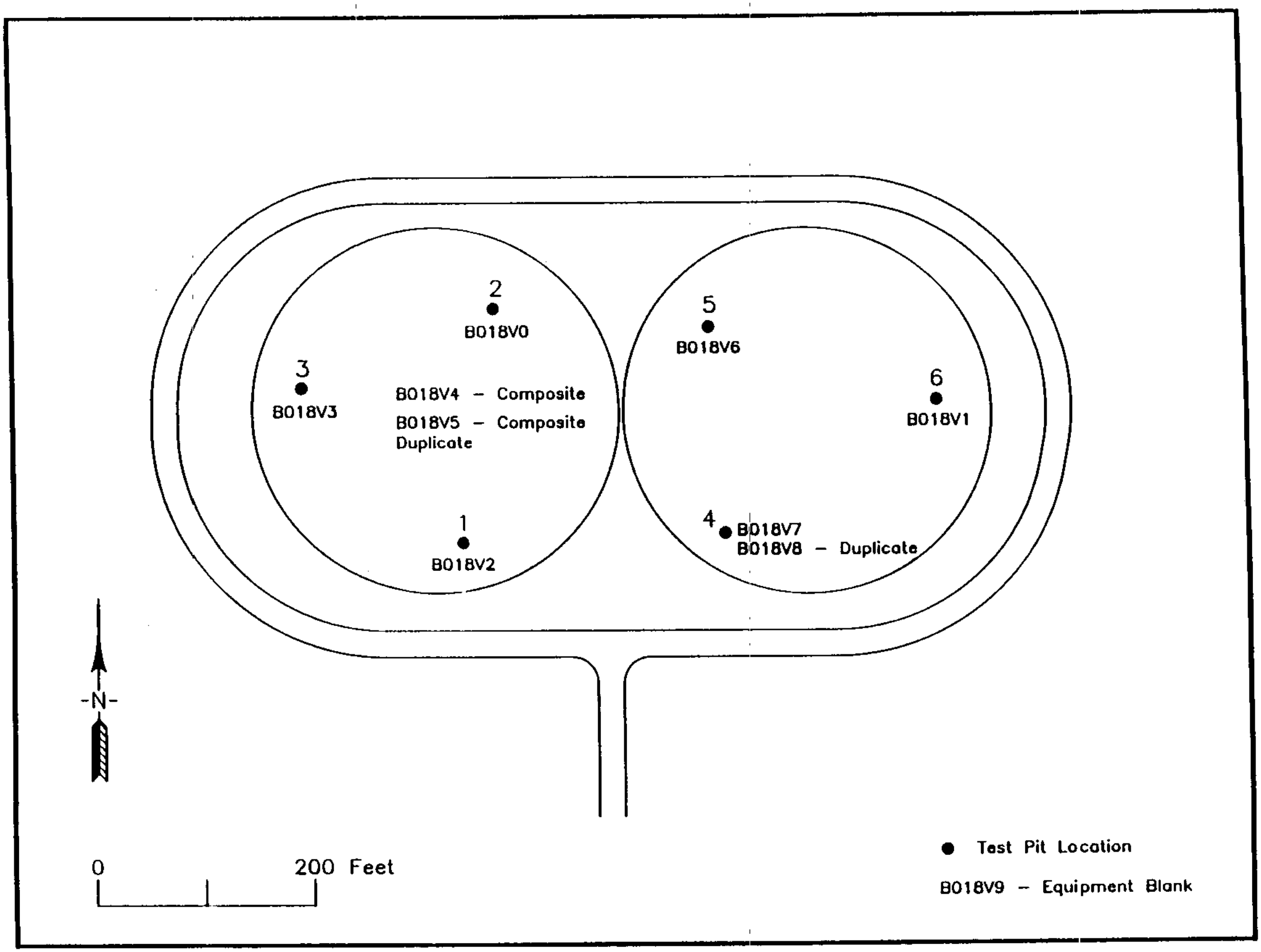

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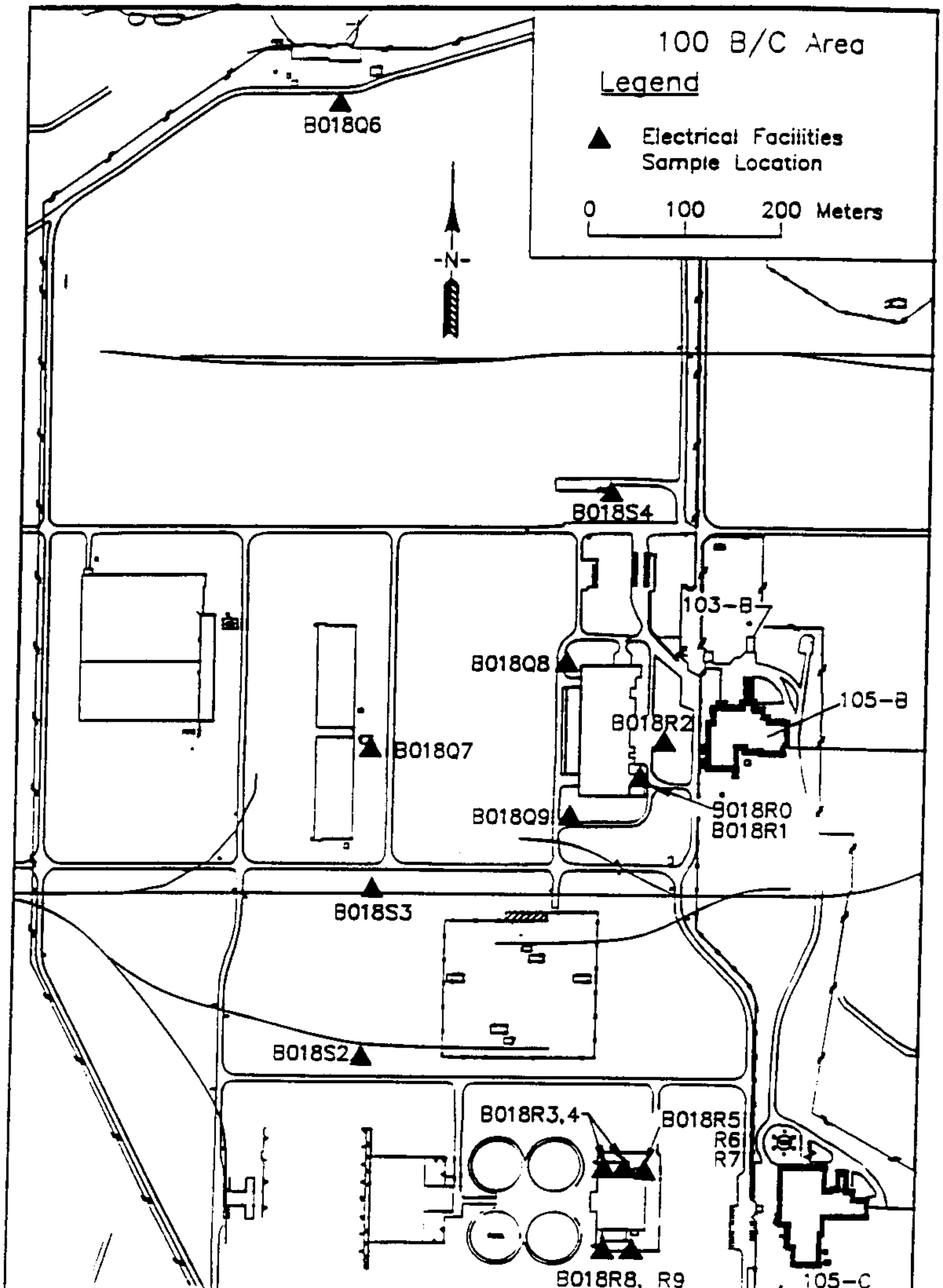
Figure 3-11 Location of 116-C-5 Retention Basin Sludge Sampling Test Pits

Figure 3-12 Location of Electrical Facilities Sampling Locations



B018S0 – Field Blank
B018S1 – Equipment Blank

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Table 3-1 116-B-1 Vadose Zone Borehole Sample Analysis Matrix

Sample Number Sample Interval Date Sampled Laboratory	B05XY1 15 - 17 3/23/92 TMA[b]	B05XY4 17 - 19 3/23/92 TMA	B05XY5 20 - 22 3/24/92 TMA	B05XY6 25 - 27 3/24/92 TMA	B05XY7 Blank[a] 4/01/92 TMA
Analytical Parameters	Environmental Data Transmission Numbers[c]				
CLP TAL Inorganics[d]	X01474	X01474	X01474	X01474	X01016
CLP TCL VOCs[e]	X01474	X01474	X01474	X01474	X01016
CLP TCL Semi-VOLs[f]	X01474	X01474	X01474	X01474	X01016
CLP TCL Pest/PCB[g]	X01474	X01474	X01474	X01474	X01016
Radionuclides	X01269	X01269	X01269	X01269	X01148
Wet Chemistry	X01474	X01474	X01474	X01474	X01016

Borehole coordinates: WCS83S (meters) N:145,275.15 E:565,523.48

[a] = Equipment blank sample
[b] = Environmental Data Transmission numbers identify records containing the analytical data
[c] = TMA Norcal
[d] = U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) - e.g., metals and cyanide
[e] = EPA CLP Target Compound List (TCL) of volatile organic compounds (VOC)
[f] = EPA CLP TCL of semi-volatile compounds
[g] = EPA CLP TCL of pesticides and polychlorinated biphenyls (PCB)

Table 3-2 Metals in 116-B-1 Vadose Borehole Soil Samples Above the Hanford Site Background 95% Upper Threshold Limit (concentrations in mg/kg)

Analytes	Sample and Sample Interval (ft bls)		Hanford Site Background 95% UTL
	B05XY1, 15 - 17	B05XY4, 17 - 19	
Chromium	33	A	27.9
Manganese	A	839	612
Zinc	128	A	79

A = Concentration less than Hanford Site background 95% upper threshold limit (UTL)

Table 3-3 Radionuclides Detected in 116-B-1 Vadose Borehole Soil Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)			
	B05XY1 15 - 17	B05XY4 17 - 19	B05XY5 20 - 22	B05XY6 25 - 27
Gross Alpha	0*	8.89R	5.18R	1.9R
Gross Beta	201	76.7R	54.3	N/D
Carbon-14	3.77J	6.18J	3.76J	1.89J
Cobalt-60	4.167	1.589J	0.389	N/D
Strontium-90	13.2	6.38	5.08	1.54
Cesium-137	43.85	22.99J	10.36	1.394
Europium-152	121.9	59.15J	17.56	4.114
Europium-154	9.9	4.749J	1.195	N/D
Plutonium-238	0.108R	0.088R	N/D	N/D
Plutonium-239	3.6R	0.92R	0.269	N/D
Americium-241	0.482R	0.13R	0.05	0.002

* = Interpreted as 0, analysis reported negative concentrations
R = Value marked as rejected in validation because of missing calibration data
J = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes detection limit

Table 3-4 116-B-1 Vadose Zone Borehole Field Screening Data for Radioactivity

Depth Interval (ft bls)	Gross Gamma (cpm)	Beta-Gamma (cpm)	Sample
0.0 - 15.0	Not Detected	Not Detected	
15.0 - 17.0	14,000	250	B05XY1
17.0 - 19.5	3,000	250	B05XY4
20.0 - 22.5	2,500	Not Detected	B05XY5
25.0 - 27.0	1,200	Not Detected	B05XY6

Table 3-5 116-B-1 Vadose Zone Borehole Spectral Gamma Geophysical Logging Results

Radionuclide	Occurrence Interval (ft bls)	Maximum Activity (pCi/g) and Interval (ft bls)
Cobalt-60	13 to 19	< 10 at 16
Cesium-137	14 to 23	50 at 16
Europium-152	13 to 23	200 at 16
Europium-154	14 to 23	12 at 16

Table 3-6 Comparison of Radionuclides Detected 116-B-1 Trench In 15 ft to 22 ft bls Interval With Samples B17 and B20 from Dorian and Richards (1978) (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)				
	B17[a] 17	B05XY1 15 - 17	B05XY4 17 - 19	B20[a] 20	B05XY5 20 - 22
Carbon-14	N/D	3.770^{J}	6.18^{J}	N/D	3.76^{J}
Cobalt-60	4.6	4.167	1.589^{J}	0.153	0.389
Strontium-90	2.24	13.2	6.38	4.2	5.08
Cesium-134	0.003	N/D	0.453^{J}	0.001	N/D
Cesium-137	24.9	43.85	22.99^{J}	7.608	10.36
Europium-152	97.3	121.9	59.15^{J}	11.057	17.56
Europium-154	13.6	9.9	4.749^{J}	0.963	1.195
Europium-155	1.2	N/D	N/D	0.051	N/D
Uranium-238	0.28	N/D	N/D	0.25	N/D
Plutonium-238	0.015	0.108	0.088	N/D	N/D
Plutonium-239	0.99	3.6^{R}	0.92^{R}	0.11	0.269
Americium-241	N/D	0.482^{R}	0.13^{R}	N/D	0.05

[a] = Concentrations from Dorian and Richards (1978) decayed to 1992
[b] = Interpreted as 0, analysis reported negative concentrations
^{R} = Value marked as rejected in validation because of missing calibration data
^{J} = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes detection limit

Table 3-7 116-B-2 Vadose Zone Borehole Sample Analysis Matrix

Sample Number Sample Interval Date Sampled Laboratory	B05Y20 9.7 - 12.0 3/23/92 TMA[a]	B05Y21 15.0 - 17.8 3/24/92 TMA	B05Y22 20.0 - 22.5 3/25/92 TMA	B05Y23 20.0 - 22.5 3/25/92 TMA
Analytical Parameters	Environmental Data Transmission Numbers[b]			
CLP TAL Inorganics[c]	X01474	X01474	X00932	X00932
CLP TCL VOCs[d]	X01474	X01474	X00932	X00932
CLP TCL Semi-VOLs[e]	X01474	X01474	X00932	X00932
CLP TCL Pest/PCB[f]	X01474	X01474	X00932	X00932
Radionuclides	X01269	X01269	X01148	N/A
Wet Chemistry	X01474	X01474	X00932	X00932

Borehole coordinates: WCS83S (meters) N:144,516.37 E:565,396.56

[a] = TMA Norcal
[b] = Environmental Data Transmission (EDT) numbers identify records containing the analytical data
[c] = U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) - e.g., metals and cyanide
[d] = EPA CLP Target Compound List (TCL) of volatile organic compounds (VOC)
[e] = EPA CLP TCL of semi-volatile compounds
[f] = EPA CLP TCL of pesticides and polychlorinated biphenyls (PCB)
N/A = Not Analyzed

Table 3-8 Detected Radionuclides in 116-B-2 Vadose Borehole Soil Samples (concentrations in pCi/g)

Analytes	Sample Number and Sample Interval (ft bls)		
	B05Y20 9.7 - 12.0	B05Y21 15.0 - 17.8	B05Y22 20.0 - 22.5
Gross Alpha	2.26[R]	2.93[R]	0[*]
Gross Beta	123	N/D	N/D
Carbon-14	3.03[J]	3.95[J]	N/D
Cobalt-60	0.135	N/D	N/D
Strontium-90	64.1	0.988	0.4[J]
Cesium-137	91.32	N/D	N/D
Europium-152	10.36	N/D	N/D
Europium-154	0.564	N/D	N/D
Plutonium-238	0.033[R]	N/D	0.053[J]
Plutonium-239	5.71[R]	N/D	N/D
Americium-241	0.023[R]	0.366	0[*J]

[*] = Interpreted as 0, analysis reported negative concentrations
[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies
N/D = Not detected, data package contains detection limits

Table 3-9 116-B-2 Vadose Zone Borehole Field Screening Data for Radioactivity

Depth Interval (ft bls)	Gross Gamma (cpm)	Beta-Gamma (cpm)	Sample
0.0 - 2.5	2,500	Not Detected	
2.5 - 2.6	2,400	Not Detected	
2.6 - 7.2	2,200	Not Detected	
7.2 - 7.6	2,200	Not Detected	
7.6 - 10.0	2,900	200	
9.7 - 12.0	6,000	200	B05Y20
12.05 - 14.6	8,000	750	
14.6 - 15.1	6,000	250	
15.1 - 16.0	2,400	Not Detected	B05Y21
16.0 - 17.8	2,400	Not Detected	
17.8 - 18.4	2,600	500	
18.4 - 20.0	2,400	Not Detected	
20.0 - 21.0	2,600	Not Detected	
21.2 - 22.5	2,600	Not Detected	B05Y22
22.5 - 23.5	2,400	Not Detected	

Table 3-10 116-B-2 Vadose Zone Borehole Spectral Gamma Geophysical Logging Results

Radionuclide	Occurrence Interval (ft bls)	Maximum Activity (pCi/g) and Interval (ft bls)
Cobalt-60	10	<1 at 10
Cesium-137	7 to 18	185 at 10
Europium-152	8 to 16	20 at 10
Europium-154	9 to 12	2 at 10

Table 3-11 Volatile and Semi-Volatile Compounds Detected in Well 199-B4-9 Soil Samples (concentrations in $\mu g/kg$)

Analytes	Sample and Sample Interval (ft bls)					
	B05XX5 16.0 - 18.0	B05XX6 26.0 - 28.0	B05XX7 30.0 - 31.5	B05XX8 60.0 - 63.0	B05XX9 67.0 - 71.0	B05XY0[a] 67.0 - 71.0
Acetone[b]	N/D	N/D	N/D	11	N/D	N/D
Benzoic acid	N/D	N/D	N/D	N/D	N/D	71[J]
Benzyl alcohol	380	N/D	N/D	N/D	N/D	N/D

Water Table Depth: 71.3 ft below land surface

[a] = Quality control sample
[b] = Volatile organic compound
[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes detection limit

Table 3-12 Metals Detected in Well 199-B4-9 Soil Samples and the Hanford Site Background 95% Upper Threshold Limit (concentrations in mg/kg)

Analytes	Sample and Sample Interval (ft bls)					
	B05XX5 16.0 - 18.0	B05XX6 26.0 - 28.0	B05XX7 30.0 - 31.5	B05XX9 67.0 - 71.0	B05XY0 67.0 - 71.0	Hanford Site Background 95% UTL
Cadmium	N/D	0.86	N/D	N/D	N/D	0.66
Chromium	116[J]	136[J]	69.2[J]	257[J]	46.6[J]	27.9
Mercury	2.49[J]	B	N/D	N/D	N/D	1.25
Nickel	B	N/D	N/D	117[J]	N/D	25.3

Water Table Depth: 71.3 ft below land surface

[J] = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes contract required detection limit
B = Value is below Hanford Site Background 95% upper threshold limit (UTL) (DOE/RL-92-94 Rev. 1)

Table 3-13 Radionuclides Detected in Well 199-B4-9 Soil Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)				
	B05XX5 16.0 - 18.0	B05XX6 26.0 - 28.0	B05XX8 60.0 - 63.0	B05XX9 67.0 - 71.0	B05XY0^{A} 67.0 - 71.0
Gross Alpha	13^{R}	6.8^{R}	6.3^{R}	3.7^{R}	9.9^{R}
Gross Beta	110^{R}	32^{R}	29^{R}	30^{R}	3^{R}
Sodium-22	1.36^{J}	N/D	N/D	N/D	N/D
Cobalt-58	0.275^{J}	N/D	N/D	N/D	N/D
Cobalt-60	8.97^{J}	N/D	N/D	N/D	N/D
Strontium-90	1^{J}	1	1.2	1	1.8
Cesium-134	N/D	N/D	N/D	N/D	0.04^{J}
Cesium-137	13.7^{J}	14.3^{J}	2.16^{J}	1.92^{J}	N/D
Europium-154	2.91^{J}	N/D	N/D	N/D	N/D
Radium-226	N/D	1.51^{J}	1.04^{J}	1.06^{J}	0.994^{J}
Thorium-228	0.553^{J}	0.605^{J}	0.589^{J}	0.39^{J}	0.745^{J}
Uranium-235	0.015^{J}	0.013	N/D	0.006	N/D
Uranium-238	0.37^{J}	0.32	0.21	0.18	0.19
Plutonium-239/240	1.1^{J}	0.044	N/D	N/D	N/D
Americium-241	0.35^{J}	0.005^{J}	0.009	0.008^{R}	0.009^{R}

Water Table Depth: 71.3 ft below land surface

^{A} = Quality control sample
^{R} = Value marked as rejected in validation because of missing calibration data
^{J} = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes contract required detection limit

Table 3-14 Well 199-B4-9 Borehole Spectral Gamma Geophysical Logging Results

Radionuclide	Occurrence Interval (ft bls)	Maximum Activity (pCi/g) and Interval (ft bls)
Cobalt-60	13 to 26	13 at 19
Cesium-137	13 to 78	60 at 19
Europium-152	14 to 26	67 at 19
Europium-154	15 to 27	<7 at 19

< = less than

No man-made radionuclides were detected at maximum survey depth of 78 ft bls by the long count spectra.

Table 3-15 Comparison of 116-B-2 LFI Borehole Radionuclide Concentrations With Maximum Concentrations From Dorian and Richards (1978) Boreholes A, B, D, and E (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)						
	B05Y20[a] 9.7 - 12.0	E[b] 12.5	B, E[c] 15	B05Y21[a] 15.0 - 17.8	A, B, D[c] 20	B05Y22[a] 20.0 - 22.5	A, B[c] 25
Carbon-14	3.03[J]	N/D	N/D	3.95[J]	N/D	N/D	N/D
Cobalt-60	0.135	0.03	0.065 B	N/D	0.073 A	N/D	0.013 B
Strontium-90	64.1	33.9	52.2 E	0.988	29.83 B	0.4[J]	5.49 B
Cesium-137	91.32	12.45	42.9 B	N/D	25.6 A	N/D	3.87 B
Europium-152	10.36	0.97	4.2 B	N/D	0.93 AB	N/D	0.27 B
Europium-154	0.564	0.06	0.31 B	N/D	0.11 A	N/D	N/D
Europium-155	N/D	0.18	0.34 E	N/D	0.24 A	N/D	0.027 B
Uranium-238	N/D	N/D	N/D	N/D	0.24 B	N/D	N/D
Plutonium-238	0.033[R]	N/D	N/D	N/D	N/D	0.053[J]	N/D
Plutonium-239	5.71[R]	0.99	1.4 B	N/D	0.89 A	N/D	0.15 A
Americium-241	0.023[R]	N/D	N/D	0.366	N/D	0[*J]	N/D

[a] = 100-BC-1 limited field investigation result
[b] = Maximum concentrations from borehole E (Dorian and Richards 1978) decayed to 1992
[c] = Maximum concentrations from Dorian and Richards (1978) decayed to 1992
[*] = Interpreted as 0, analysis reported negative concentrations
[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes detection limit
Borehole indicated by letter adjacent to concentration, e.g., "1.4 B" indicates 1.4 pCi/g from borehole B

Table 3-16 116-B-3 Vadose Zone Borehole Sample Analysis Matrix

Sample Number Sample Interval Date Sampled Laboratory	B05XY7 Blank[a] 4/01/92 TMA[c]	B05XY8 7.4 - 9.4 4/06/92 TMA	B05XZ0 10.7 - 12.7 4/07/92 TMA	B05XZ1 10.7 - 12.7[b] 4/07/92 Weston[d]	B05XZ2 10.7 - 12.7 4/07/92 TMA	B05XZ3 14.8 - 16.8 4/08/92 TMA
Analytical Parameter	Environmental Data Transmission Numbers[e]					
CLP TAL Inorganics[f]	X01016	X01280	X01280	X00901	N/A	X01264
CLP TCL VOCs[g]	X01016	X01280	X01280	X00901	X01264	X01264
CLP TCL Semi-VOLs[h]	X01016	X01280	X01280	X00901	N/A	X01264
CLP TCL Pest/PCB[i]	X01016	X01280	X01280	X00901	N/A	X01264
Radionuclides	X01148	X01270	X01270	X01471	N/A	X01270
Wet Chemistry	X01016	X01280	X01280	X00901	N/A	X01264

Borehole coordinates: WCS83S (meters) N:144,527.21 E:565,358.04

[a] = Equipment blank
[b] = Split sample
[c] = TMA Norcal
[d] = Roy F. Weston
[e] = Environmental Data Transmission (EDT) numbers identify records containing the analytical data
[f] = U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) - e.g., metals and cyanide
[g] = EPA CLP Target Compound List (TCL) of volatile organic compounds (VOC)
[h] = EPA CLP TCL of semi-volatile compounds
[i] = EPA CLP TCL of pesticides and polychlorinated biphenyls (PCB)
N/A = Not Analyzed

Table 3-17 Volatile Organic Compounds Detected in Vadose Borehole at 116-B-3 (concentrations are in $\mu g/kg$)

Analytes	Sample and Sample Interval (ft bls)			
	B05XY8 7.4 - 9.4	B05XZ0 10.7 - 12.7	B05XZ1 10.7 - 12.7	B05XZ3 14.8 - 16.8
Acetone	N/D	N/D	40.00	N/D
2-Butanone	N/D	5.00[J]	N/D	N/D
Benzene	1.00[J]	N/D	N/D	N/D
4-Methyl-2-pentanone	N/D	3.00[J]	N/D	1.00[J]

[J] = Value estimated, due to quality control deficiencies
N/D = Not Detected, detection limit in data package

Table 3-18 Semi-Volatile Organic Compounds Detected in Vadose Borehole at 116-B-3 (concentrations in $\mu g/kg$)

Analytes	Sample and Sample Interval (ft bls)	
	B05XY8 7.4 - 9.4	B05XY8RE 7.4 - 9.4
Anthracene	27^J	20^J
Benzo(A)anthracene	160^J	150^J
Benzo(B)fluoranthene	89^J	100^J
Benzo(K)fluoranthene	130^J	83^J
Benzo(A)pyrene	97^J	96^J
Chrysene	190^J	150^J
Fluoranthene	310^J	270^J
Phenanthrene	120^J	100^J

^{J} = Value estimated, due to quality control deficiencies
* = RE code indicates sample re-extraction and analysis

Table 3-19 Metals Detected in 116-B-3 Vadose Borehole Soil Samples Above the Hanford Site Background 95% Upper Threshold Limit (concentrations in mg/kg)

Analytes	Sample and Sample Interval (ft bls)				Hanford Site Background 95% UTL
	B05XY8 7.4 - 9.4	B05XZ0 10.7- 12.7	B05XZ1 10.7 - 12.7	B05XZ3 14.8 - 16.8	
Cadmium	N/D	1.8	1.3[J]	A	0.66
Chromium	A	A	A	44.50[J]	27.9
Silver	N/D	N/D	3.00	N/D	2.7

[J] = Value estimated, due to quality control deficiencies
A = Concentration less than Hanford Site background 95% upper threshold limit
N/D = Not Detected, detection limit in data package

Table 3-20 Radionuclides Detected in 116-B-3 Vadose Borehole Soil Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)			
	B05XY8 7.4 - 9.4	B05XZ0 10.7 - 12.7	B05XZ1 10.7 - 12.7	B05XZ3 14.8 - 16.8
Gross Alpha	0^{*R}	2.76^{R}	5.0^{R}	0^{*R}
Gross Beta	207^{R}	N/D	N/D	N/D
Carbon-14	N/D	3.58^{J}	N/D	N/D
Strontium-90	39.2^{J}	N/D	4.9^{R}	0.587^{J}
Cesium-137	78.58	4.705^{J}	2.78^{R}	0.253^{J}
Thorium-228	N/D	N/D	0.723^{R}	N/D
Plutonium-238	0.035^{J}	N/D	N/D	N/D
Plutonium-239	0.791^{J}	N/D	N/D	N/D
Americium-241	0.083	0.024	N/D	0.020

* = Interpreted as 0, analysis reported negative concentrations
^{R} = Value marked as rejected in validation because of missing calibration data
^{J} = Value estimated, due to quality control deficiencies
N/D = Not Detected, data package contains detection limit

Table 3-21 116-B-3 Vadose Zone Borehole Field Screening Data for Radioactivity

Depth Interval (ft bls)	Gross Gamma (cpm)	Beta-Gamma (cpm)	Sample
0.0 - 5.8	3,500	Not Detected	
5.8 - 7.4	8,000	400	
7.4 - 9.4	4,500	250	B05XY8
9.4 - 10.7	5,000	150	
10.7 - 12.7	5,000	150	B05XZ0
12.7 - 14.8	4,500	Not Detected	
14.8 - 16.8	4,500	Not Detected	B05XZ3
16.8 - 17.5	4,500	Not Detected	
17.5 - 18.5	3,600	Not Detected	
18.5 - 20.0	4,000	Not Detected	

Table 3-22 116-B-5 Vadose Zone Borehole Sample Analysis Matrix

Sample Number Sample Interval Date Sampled Laboratory	B05Y24 6.6 - 8.6 4/16/92 TMA[a]	B05Y25 10.0 - 11.2 4/20/92 TMA	B05Y26 15.0 - 17.0 4/21/92 TMA
Analytical Parameters	Environmental Data Transmission Numbers[b]		
CLP TAL Inorganics[c]	X01263	X01266	X01266
CLP TCL VOCs[d]	X01263	X01266	X01266
CLP TCL Semi-VOLs[e]	X01263	X01266	X01266
CLP TCL Pest/PCB[f]	X01263	X01266	X01266
Radionuclides	X01270	X01270	X01270
Wet Chemistry	X01263	X01266	X01266

Borehole coordinates: WCS83S (meters) N:144,762.12 E:565,289.19

[a] = TMA Norcal
[b] = Environmental Data Transmission (EDT) numbers identify records containing the analytical data
[c] = U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) - e.g., metals and cyanide
[d] = EPA CLP Target Compound List (TCL) of volatile organic compounds (VOC)
[e] = EPA CLP TCL of semi-volatile compounds
[f] = EPA CLP TCL of pesticides and polychlorinated biphenyls (PCB)

Table 3-23 Volatile Organic Compounds Detected 116-B-5 Vadose Zone Borehole (concentrations are in μg/kg)

Analytes	Sample and Sample Interval (ft bls)			
	B05Y24 6.6 - 8.6	B05Y25 10.0 - 11.2	B05Y25RE 10.0 - 11.2	B05Y26 15.0 - 17.0
Carbon disulfide	4[J]	N/R	200[J]	N/D
Toluene	25	N/R	77[J]	N/D

[J] = Value estimated, due to quality control deficiencies
N/R = Not Reported
N/D = Not Detected, data package contains the detection limits

Table 3-24 Metals Detected in 116-B-5 Vadose Borehole Soil Samples Above the Hanford Site Background 95% Upper Threshold Limit (concentrations in mg/kg)

Analytes	Sample and Sample Interval (ft bls)			Hanford Site Background 95% UTL
	B05Y24 6.6 - 8.6	B05Y25 10.0 - 11.2	B05Y26 15.0 - 17.0	
Barium	90.2[A]	484	78.60[A]	171
Mercury	1.40	1.10[J][A]	2.90[J]	1.25
Zinc	68.40[A]	69.40[A]	125.00	79

[A] = Concentration less than Hanford Site background 95% upper threshold limit
[J] = Value estimated, due to quality control deficiencies

Table 3-25 Radionuclides Detected in 116-B-5 Vadose Borehole Soil Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)		
	B05Y24 6.6 - 8.6	B05Y25 10.0 - 11.2	B05Y26 15.0 - 17.0
Gross Alpha	3.060[R]	3.610[R]	6.790[R]
Cobalt-60	0.134[J]	0.260[J]	0.184[J]
Strontium-90	0.00[J]	0[*]	0.150[J]
Cesium-137	0.132[J]	N/D	N/D
Europium-152	1.166[J]	1.527[J]	N/D
Americium-241	0.006	0.002	0.002

[*] = Interpreted as 0, analysis reported negative concentrations
[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies
N/D = Not Detected, see data package for detection limit

Table 3-26 116-B-5 Vadose Zone Borehole Field Screening Data for Radioactivity

Depth Interval (ft bls)	Gross Gamma (cpm)	Beta-Gamma (cpm)	Sample
6.6 - 9.6	2,000	Not Detected	B05Y24
10.0 -11.2	2,000	Not Detected	B05Y25
11.6	2,350	Not Reported	
12.0	3,000	Not Reported	
12.0 - 13.0	2,660	Not Reported	
13.0 - 17.0	2,000	Not Reported	
15.0 - 17.0	1,800	Not Detected	B05Y26
17.5	1,800	Not Reported	
20.6 - 24.6	2,000	Not Reported	

Table 3-27 116-B-5 Vadose Zone Borehole Spectral Gamma Geophysical Logging Results

Radionuclide	Occurrence Interval (ft bls)	Maximum Activity (pCi/g) and Interval (ft bls)
Cobalt-60	5 to 17	<1.5 13 - 17 broad curve
Europium-152	3 to 15	<7 at 10
Europium-154	3 to 12	<1

Table 3-28 Comparison of 116-B-5 LFI Borehole Radionuclide Concentrations With Maximum Concentrations From Dorian and Richards (1978) Boreholes A and B (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)					
	B05Y24[a] 6.6 - 9.6	A[b] 8	A[b] 10	B05Y25[a] 10 - 11	B05Y26[a] 15 - 17	B[b] 22.5
Cobalt-60	0.134[J]	2.48	0.20	0.260[J]	0.184[J]	N/D
Strontium-90	0.0[J]	0.0814	0.108	0.0[*]	0.150[J]	N/D
Cesium-137	0.132[J]	0.31	0.04	N/D	N/D	N/D
Europium-152	1.166[J]	11.49	0.84	1.527[J]	N/D	N/D
Europium-154	N/D	2.51	N/D	N/D	N/D	N/D
Europium-155	N/D	0.014	N/D	N/D	N/D	N/D
Americium-241	0.006	N/D	N/D	0.002	0.002	N/D
Tritium	N/A	29,000	1,589	N/A	N/A	179

[a] = 100-BC-1 limited field investigation data
[b] = Concentrations from Dorian and Richards (1978) decayed to 1992
[*] = Interpreted as 0, analysis reported negative concentrations
[J] = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes detection limit
N/A = Not Analyzed

Table 3-29 116-C-5 West Retention Basin Sludge Sample Analysis Matrix

Sample Number Test Pit Number Date Sampled Laboratory	B018V0 2 4/28/92 TMA[c]	B018V1 6 4/28/92 TMA	B018V1A 6[a] 4/28/92 Weston[d]	B018V1B 6[b] 4/28/92 Weston	B018V2 1 4/28/92 TMA	B018V3 3 4/28/92 TMA	B018V4 Composite 4/28/92 TMA	B018V5 Composite[a] 4/28/92 TMA
Analytical Parameters	Environmental Data Transmission Numbers[e]							
CLP TAL Inorganics[f]	N/A	X01473	N/A	N/A	N/A	N/A	X01473	X01473
CLP TCL VOCs[h]	X01391	N/A	X01294	X01473	X01473	X01473	X01473	X01473
CLP TCL Semi-VOLs[i]	N/A	N/A	X01294	N/A	N/A	N/A	X01473	X01473
CLP TCL Pest/PCB[j]	N/A	N/A	X01294	N/A	N/A	N/A	X01473	X01473
Radionuclides	N/A	X01368	N/A	N/A	N/A	N/A	X01368	X01368
Wet Chemistry	N/A	X01473	X01294	N/A	N/A	N/A	X01473	X01473

[a] = Duplicate Sample
[b] = Split sample
[c] = TMA Norcal
[d] = Roy F. Weston
[e] = Environmental Data Transmission (EDT) numbers identify records containing the analytical data
[f] = U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) - e.g., metals and cyanide
[g] = not analyzed
[h] = EPA CLP Target Compound List (TCL) of volatile organic compounds (VOC)
[i] = EPA CLP TCL of semi-volatile compounds
[j] = EPA CLP TCL of pesticides and polychlorinated biphenyls (PCB)

Table 3-30 116-C-5 East Retention Basin Sludge Sample Analysis Matrix

Sample Number Test Pit Number Date Sampled Laboratory	B018V6 5 4/28/92 TMA[c]	B018V6A 5 4/28/92 Weston[d]	B018V6B 5[a] 4/28/92 Weston	B018V7 4[b] 4/28/92 TMA	B018V7A 4 4/28/92 Weston	B018V7B 4 4/28/92 Weston	B018V8 4[a] 4/28/92 TMA	B018V8A 4[a] 4/28/92 Weston	B018V8B 4[a] 4/28/92 Weston	B018V9 Blank 4/28/92 TMA
Analytical Parameters	Environmental Data Transmission Numbers[e]									
CLP TAL Inorganics[f]	X01473	N/A	X01427	X01473	N/A	X01427	X01473	N/A	X01427	X01473
CLP TCL VOCs[h]	N/A	X01294	N/A	N/A	X01294	N/A	X01473	X01294	N/A	X01473
CLP TCL Semi-VOLs[i]	N/A	X01494	N/A	N/A	X01294	N/A	X01473	X01294	N/A	X01473
CLP TCL Pest/PCB[j]	N/A	X01294	N/A	N/A	X01294	N/A	X01473	X01294	N/A	X01473
Radionuclides	X01368	N/A	N/A	X01368	N/A	N/A	X01368	N/A	N/A	X01368
Wet Chemistry	X01473	X01294	N/A	X01473	X01294	N/A	X01473	X01294	N/A	X01473

[a] = Duplicate Sample
[b] = Split sample
[c] = TMA Norcal
[d] = Roy F. Weston
[e] = Environmental Data Transmission (EDT) numbers identify records containing the analytical data
[f] = U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) - e.g., metals and cyanide
[g] = not analyzed
[h] = EPA CLP Target Compound List (TCL) of volatile organic compounds (VOC)
[i] = EPA CLP TCL of semi-volatile compounds
[j] = EPA CLP TCL of pesticides and polychlorinated biphenyls (PCB)

Table 3-31 Semi-Volatile Organic Compounds Detected in 116-C-5 Retention Basin Sludge Samples (concentrations are in μg/kg)

Analytes	Sample, Location, and Type			
	B018V4RE West Basin Composite	B018V6A East Basin Grab	B018V7A East Basin Grab	B018V8A East Basin Duplicate of B018V7
Benzo(A)anthracene	N/D	N/D	77[J]	N/D
Benzo(B)fluoranthene	N/D	N/D	100[J]	54[J]
Benzo(K)fluoranthene	42[J]	N/D	100[J]	44[J]
Chrysene	N/D	N/D	100[J]	N/D
Fluoranthene	46[J]	N/D	67[J]	N/D
Pentachlorophenol	N/D	920[J]	N/D	770[J]

[J] = Value estimated, due to quality control deficiencies
N/D = Not Detected, see data package for detection limit

Table 3-32 Metals Detected in 116-C-5 Retention Basin Above the Hanford Site Background 95% Upper Threshold Limit Value (concentrations in mg/kg)

Sample	Location	Type	Chromium	Copper	Iron	Lead	Mercury	Zinc
B018V4	West Basin	Composite	226[J]	28.1[*]	40,600	180	2.9	125
B018V5	East Basin	Grab	270[J]	27.9[*]	39,200	133	4.3	138
B018V6	East Basin	Grab	336[J]	22.1[*]	42,100	564[J]	2.6	131
B018V6B	East Basin	Duplicate of B018V6	137[J]	15.2[*]	23,000[J]	129[J]	N/R	77.9[*J]
B018V7	East Basin	Grab	609[J]	46.8	44,600	353	3.4	309
B018V7B	East Basin	Duplicate of B018V7	453[J]	35.2	39,600[J]	106[J]	N/R	259[J]
B018V8	East Basin	Grab	335[J]	30.9	42,800	108	2	161
B018V8B	East Basin	Duplicate of B018V8	226[J]	18.2[*]	28,300[J]	82.1[J]	N/R	133[J]
Hanford Site background 95% UTL			27.9	28.2	39,160	14.75	1.25	79

[J] = Value estimated, due to quality control deficiencies
[*] = Value less than Hanford Site Background 95% upper threshold limit (UTL)
N/R = Not Reported

Table 3-33 Radionuclides Detected in 116-C-5 Test Pit Sludge Samples (concentrations in pCi/g)

Analytes	Sample, Location, Type					
	B018V4 West Basin Composite	B018V5 West Basin Duplicate of B018V4	B018V1 East Basin Grab	B018V6 East Basin Grab	B018V7 East Basin Grab	B018V8 East Basin Duplicate of B018V7
Gross Alpha	22[R]	N/D	N/D	52[R]	110[R]	75[R]
Gross Beta	2,400	1,900	83[J]	1,300[J]	2,700	3,700
Cobalt-60	180	160	10	130	310	300
Strontium-90	180	94	7.8[J]	110	770	540
Cesium-137	790	720	5.1	200	800	450
Europium-152	1,400	1,300	81	820	1,100	1,400
Europium-154	250	240	20	150	380	410
Europium-155	18	11	1.9[J]	11	31	41
Radium-226	N/D	N/D	0.84	N/D	N/D	N/D
Uranium-233/234	1.40[R]	N/D[R]	N/D[R]	N/D[R]	1.20[R]	N/D[R]
Uranium-235	N/D[R]	N/D[R]	N/D[R]	N/D[R]	0.08[R]	N/D[R]
Uranium-238	1.30[R]	N/D[R]	N/D[R]	N/D[R]	N/D[R]	N/D[R]
Plutonium-238	1.20[R]	0.93[R]	0.041[R]	0.85[R]	1.8[R]	9.4[R]
Plutonium-239/240	36[R]	22[R]	0.86[R]	22[R]	52[R]	190[R]
Americium-241	13[R]	7.50[R]	0.85[R]	7.7[R]	29[R]	34

[R] = Value marked as rejected, calibration data absent
[J] = Value estimated, due to quality control deficiencies
N/D = Not Detected, see data package for detection limit

Table 3-34 116-C-5 Retention Basin Test Pit Field Screening Data for Beta-Gamma Activity in Counts per Minute

Basin	Test Pit / Sample	Soil Surface ($\beta\gamma$ cpm)	Sludge ($\beta\gamma$ cpm)
East	No. 4 / B018V7, B018V8	6,000	10,000
East	No. 5 / B018V6	800	4,000
East	No. 6 / B018V1	2,000	5,000 - 6,000
West	No. 1 / B018V2	Not Reported	9,000
West	No. 2 / B018V0	Not Reported	4,000
West	No. 3 / B018V3	Not Reported	8,000

Table 3-35 116-C-5 Vadose Test Pit Sample Analysis Matrix

Sample Number Sample Interval Date Sampled Laboratory	B018X0 Blank[a] 6/10/92 TMA[c]	B018X1 1.5 6/10/92 TMA	B018X2 5.0 6/10/92 TMA	B018X3 10 6/10/92 TMA	B018X4 15 6/10/92 TMA	B018X5 20 6/10/92 TMA	B018X6 20[b] 6/10/92 Weston[d]
Analytical Parameters	Environmental Data Transmission Numbers[e]						
CLP TAL Inorganics[f]	X01391	X01391	X01391	X01391	X01391	X01391	X01288
CLP TCL VOCs[g]	X01391	X01391	N/A	X01391	X01391	X01391	X01288
CLP TCL Semi-VOLs[h]	X01391	N/A	X01391	X01391	X01391	X01391	X01288
CLP TCL Pest/PCB[i]	X01391	N/A	X01391	X01391	X01391	X01391	X01288
Radionuclides	X01460	X01460	X01460	X01460	X01460	X01460	X01396
Wet Chemistry	X01391	X01514	X01391	X01391	X01391	X01391	X01288

[a] = Equipment blank
[b] = Split sample
[c] = TMA Norcal
[d] = Roy F. Weston
[e] = Environmental Data Transmission (EDT) numbers identify records containing the analytical data
[f] = U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) - e.g., metals and cyanide
[g] = EPA CLP Target Compound List (TCL) of volatile organic compounds (VOC)
[h] = EPA CLP TCL of semi-volatile compounds
[i] = EPA CLP TCL of pesticides and polychlorinated biphenyls (PCB)
N/A = Not Analyzed

Table 3-36 Radionuclides Detected in 116-C-5 Vadose Test Pit Soil Samples (concentrations in pCi/g)

Analytes	Sample and Sample Depth (ft bls)					
	B018X1 1.5	B018X2 5.0	B018X3 10.0	B018X4 15.0	B018X5 20.0	B018X6 20.0
Gross Alpha	7.2^{R}	10^{R}	3.9^{R}	5.7^{R}	3.9^{R}	15^{R}
Gross Beta	18	32	16	16	17	36^{R}
Carbon-14	N/D	N/D	N/D	N/D	N/D	0.41^{R}
Cobalt-60	N/D	3.2	N/D	N/D	N/D	N/D
Strontium-90	N/D	1.3^{J}	N/D	N/D	N/D	0.012^{R}
Cesium-137	0.085	9.8	0.091	N/D	N/D	N/D
Europium-152	N/D	13	0.078	N/D	N/D	N/D
Europium-154	N/D	2.0	N/D	N/D	N/D	N/D
Radium-226	N/D	0.680	N/D	N/D	N/D	1.020^{R}
Thorium-228	N/D	N/D	N/D	N/D	N/D	4.4^{R}
Uranium-233/234	N/D	N/D	N/D	0.780	0.840	N/D
Uranium-235	N/D	N/D	N/D	N/D	N/D	0.009^{R}
Plutonium-239/240	N/D	0.210^{J}	N/D	N/D	N/D	0.001^{R}
Americium-241	N/D	0.130	N/D	N/D	N/D	0.004^{R}

^{R} = Value marked as rejected in validation because of missing calibration data
^{J} = Value estimated, due to quality control deficiencies
N/D = Not Detected, see data package for detection limit

Table 3-37 116-C-5 Vadose Test Pit Field Screening Data for Radioactivity

Depth Interval (ft bls)	Beta-Gamma (cpm)	Sample
0.0	150	
2.0	100	B018X1
5.0	300	B018X2
10.0	100	B018X3
15.0	100	B018X4
20.0	100	B018X5, B018X6

Table 3-38 Maximum Concentrations of Radionuclides Detected in 116-C-5 Test Pit Sludge Samples and 1976 Radionuclide Data (Dorian and Richards 1978) Decayed to 1992 (concentrations in pCi/g)

Radionuclide	LFI 116-C-5 Maximum[a]	Location CE[b] - Decayed to 1992	Location DE - 1976 Maximum[c] Decayed to 1992
Cobalt-60	310	579	1,896
Strontium-90	770	434	529
Cesium-137	800	629	1,453
Europium-152	1,400	1,016	2,608
Europium-154	410	591	6,482
Europium-155	41	39	515
Radium-226	0.84	N/D	N/D
Uranium-233/234	1.4	N/D	N/D
Uranium-235	0.08	N/D	N/D
Uranium-238	1.3	0.9	1.6
Plutonium-238	9.4	1.23	7.9
Plutonium-239/240	190	29	230
Americium-241	34	N/A	N/A

N/A = Not Analyzed
[a] = From limited field investigation (LFI) Test Pit 4 located in SW quadrant of the east basin
[b] = From Dorian and Richards (1978), location CE was in the SW quadrant of east basin and closest to LFI Test Pit 4
[c] = From Dorian and Richards (1978), location DE was in SE quadrant of east basin

Table 3-39 Comparison of 116-C-5 LFI Vadose Test Pit Radionuclide Concentrations With Maximum Concentrations From Dorian and Richards (1978) Boreholes W, X, and Y (concentrations in pCi/g)

Analytes	Sample and Sample Depth (ft bls)					
	X, Y[a] 0	B018X1[b] 1.5	W[a] 5	B018X2[b] 5	Y[a] 20	B018X6[b] 20
Cobalt-60	0.53 X	N/D	0.14	3.20	0.089	N/D
Strontium-90	2.10 Y	N/D	0.06	1.30[J]	N/D	0.012[R]
Cesium-134	0.001	N/D	N/D	N/D	0.050	N/D
Cesium-137	3.94 X	0.085	0.166	9.8	0.214	N/D
Europium-152	7.52 X	N/D	0.49	13	0.84	N/D
Europium-154	1.47 X	N/D	N/D	2.0	0.042	N/D
Europium-155	0.08 X	N/D	N/D	N/D	N/D	N/D
Plutonium-239/240	0.57 Y	N/D	N/D	0.210[J]	0.72	0.001[R]
Americium-241	N/D	N/D	N/D	0.130	N/D	0.004[R]

[a] = Maximum concentration from Dorian and Richards (1978) decayed to 1992
[b] = limited field investigation result
[J] = Value estimated, due to quality control deficiencies
[R] = Value marked rejected during data validation, calibration data absent
N/D = Constituent not detected, data package includes detection limit
Borehole indicated by letter adjacent to concentration, e.g., "0.57 Y" indicates 0.57 pCi/g from borehole Y

Table 3-40 Volatile and Semi-volatile Organic Compounds Detected in Well 199-B3-46 Soil Samples (concentrations in $\mu g/kg$)

Analytes	Sample and Sample Interval (ft bls)	
	B05XS4 30.0 - 32.0	B05XS5 35.0 - 38.0
bis(2-Ethylhexyl)phthalate[b]	62[J]	57[J]
Diethylphthalate[b]	64[J]	340[J]
Di-n-butylphthalate[b]	3100	4300
Toluene[a]	N/D	2[J]

Water Table Depth: 48.7 ft below land surface

[a] = Volatile organic compound
[b] = Semi-volatile organic compound
[J] = Value estimated, due to quality control deficiencies
N/D = Not Detected

Table 3-41 Radionuclides Detected in Well 199-B3-46 Soil Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)	
	B05XS4 30.0 - 32.0	B05XS5 35.0 - 38.0
Gross Alpha	7.8[R]	4.4[R]
Gross Beta	32[R]	53[R]
Strontium-90	0.4[J]	7.8[J]
Cesium-137	N/D	0.154[J]
Radium-226	0.723[J]	0.786[J]
Thorium-228	0.641[J]	0.5[J]
Uranium-235	0.007	0.006
Uranium-238	0.15	0.15
Americium-241	N/D	0.01

Water Table Depth: 48.7 ft below land surface

[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package detection limit

Table 3-42 Metals Detected in 116-C-1 Soil Washing Treatability Test Pits and the Hanford Site Background 95% Upper Threshold Limit (concentrations in mg/kg)

Analytes	Sample and Sample Interval (ft bls)[a]		Hanford Site Background 95% UTL[b]
	Batch I 10 - 20 ft	Batch II 10 - 22 ft	
Aluminum	57,000	51,000	15,600
Antimony	< 16	< 19	15.7[c]
Arsenic	4	7	8.92
Barium	729	753	171
Cadmium	< 12	< 13	0.66[c]
Calcium	26,500	26,500	23,920
Chromium	56	236	27.9
Copper	44	50	28.2
Iron	45,100	55,900	39,160
Lead	13	101	14.75
Manganese	87	1,114	612
Nickel	26	37	25.3
Potassium	16,000	13,600	3,120
Selenium	< 1	< 1	5[c]
Silicon	239,000	212,500	192
Silver	< 10	< 12	2.7
Titanium	6400	6500	3,570
Vanadium	165	161	111
Zinc	88	855	79
Zirconium	211	209	57.3

[a] = Source DOE-RL 1994, analyses by non-Contract Laboratory Program (CLP) X-ray fluorescence methods

[b] Source: DOE-RL 1993b, 95% confidence limit of the 95th percentile of the data distribution, analyses by CLP methods such as inductively coupled plasma, results provided for information only

[c] Limit of detection

UTL - upper threshold limit

Table 3-43 Radionuclide Concentrations Detected in 116-C-1 Soil Washing Treatability Test Pits and in Dorian and Richards (1978) Borehole L (concentrations in pCi/g)

Analytes	Sample, Sample Interval (ft bls), and grain-size fraction[a]				
	Batch I 10 - 20 ft < 2 mm	Batch II 10 - 22 ft < 2 mm	Batch I 10 - 20 ft > 2 mm	Batch II 10 - 22 ft > 2 mm	Borehole L[b] 18 ft NA
Cobalt-60	7	525	3.2	18	23.67
Strontium-90	<0.2	115	-	-	0.19
Cesium-134	<0.8	<10	-	-	0.04
Cesium-137	0.74	5495	2	759	23.59
Europium-152	28	2320	-	-	44.29
Europium-154	4.4	337	0.6	52	11.90
Europium-155	0.54	70	-	-	0.98
Uranium-235	0.06	0.06	-	-	-
Uranium-238	1.31	1.23	-	-	0.28
Plutonium-239/240	0.08	414	-	-	0.27

[a] = Source DOE-RL 1994
[b] = Concentrations from Dorian and Richards (1978) decayed to 1992
NA = Grain size not applicable
- = Not Analyzed

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Table 3-44 Radionuclides Detected in 116-D-5 Vadose Borehole Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)	
	B018B9 20.0 - 22.0	B018C0 25.0 - 27.0
Gross Alpha	8.9[R]	0.27[R]
Gross Beta	3.3[R]	28[R]
Carbon-14	0.4[R]	0.27[R]
Strontium-90	0.47	N/D
Radium-226	0.891[J]	0.75[J]
Thorium-228	0.592[J]	0.49[J]
Uranium-235	0.0013[R]	0.0055[R]
Uranium-238	0.12[R]	0.17[R]
Plutonium-239	0[R]	0.007[R]
Americium-241	0.0013[R]	0.0[*R]

[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies
[*] = Concentration interpreted as 0, analysis reported negative concentration value
N/D = Not Detected, see data package for detection limit

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Table 3-45 Volatile and Semi-Volatile Organic Compounds Detected in Well 199-B5-2 Soil Samples (concentrations in μg/kg)

Analytes	Sample and Sample Interval (ft bls)	
	B05XX2 53.0 - 55.0	B05XX3 55.0 - 57.0
Acetone[a]	N/D	24
Diethylphthalate[b]	390	N/D

Water Table Depth: 57.5 ft below land surface

[a] = Volatile organic compound
[b] = Semi-volatile organic compound
N/D = Constituent not detected

Table 3-46 Radionuclides Detected in Well 199-B5-2 Soil Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)	
	B05XX2 53.0 - 55.0	B05XX3 55.0 - 57.0
Gross Alpha	9.4[R]	7.3[R]
Gross Beta	36[R]	37[R]
Strontium-90	2.9	2.6
Cesium-137	1.46[J]	1.14[J]
Radium-226	0.981[J]	0.89[J]
Thorium-228	0.532[J]	0.56[J]
Uranium-235	0.001	0.016
Uranium-238	0.21	0.22
Plutonium-239/240	0.002	N/D
Americium-241	0.006	N/D

Water Table Depth: 57.5 ft below land surface

[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes detection limit

Table 3-47 Volatile Organic Compounds, Semi-Volatile Organic Compounds, and Pesticides Detected in Well 199-B3-47 Soil Samples (concentrations in μg/kg)

Analytes	Sample and Sample Interval (ft bls)	
	B05XS1 30.0 - 32.5	B05XS2 39.0 - 41.5
Di-n-butylphthalate[b]	36[J]	3000
Endrin[c]	16[J]	N/D
Methylene chloride[a]	5	N/D

Water Table Depth: 44.3 ft below land surface

[a] = Volatile organic compound
[b] = Semi-volatile organic compound
[c] = Pesticide
[J] = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes detection limit

Table 3-48 Radionuclides Detected in Well 199-B3-47 Soil Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)	
	B05XS1 30.0 - 32.5	B05XS2 39.0 - 41.5
Gross Alpha	3.4[R]	4.5[R]
Gross Beta	28[R]	35[R]
Strontium-90	1.2	0.88[J]
Cesium-137	0.299[J]	0.44[J]
Radium-226	N/D	1.01[J]
Thorium-228	1.35[J]	0.465[J]
Uranium-235	N/D	0.009
Uranium-238	0.17	0.16
Americium-241	0.009	0.001[R]

Water Table Depth: 44.3 ft below land surface

[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies
N/D = Constituent not detected, data package includes detection limit

Table 3-49 Metals Detected in 116-B-6A Borehole Soil Samples Above the Hanford Site Background 95% Upper Threshold Limit (concentrations in mg/kg)

Analytes	Sample and Sample Depth (ft bls)						Hanford Site Background 95% UTL
	BH-1 11.5	BH-2 6	BH-2 8	BH-2 18	BH-3 0	Near Surface Soil	
Cadmium	A	0.92	A	A	A	21	0.66
Copper	A	92	A	38.0	A	23	28.2
Lead	48.0	94	56	21	23	16	14.75
Zinc	A	2,500	1,140	A	A	A	79

A = Concentration less than Hanford Site background 95% upper threshold limit

Table 3-50 Radionuclides Detected in 116-D-9 Vadose Borehole Samples (concentrations in pCi/g)

Analytes	Sample and Sample Interval (ft bls)	
	B018G1 18.0 - 20.8	B018G2 25.0 - 27.8
Gross Alpha	2.3[R]	2.9[R]
Gross Beta	20[R]	25[R]
Carbon-14	0.26[J]	0.15[J]
Potassium-40	7.39[J]	9.35[J]
Strontium-90	2.9[J]	0.088[J]
Radium-226	0.355[J]	0.726[J]
Thorium-228	0.352[J]	0.479[J]
Uranium-238	0.18[R]	0.32[R]
Americium-241	0.0061[R]	N/D

[R] = Value marked as rejected in validation because of missing calibration data
[J] = Value estimated, due to quality control deficiencies

Table 3-51 100-BC-1 LFI Non-Waste Site Sample Analysis Matrix

Sample Number Sample Interval Date Sampled Laboratory	B05XZ4 0.5 - 1 4/14/92 TMA[a]	B05XZ5 0.5 - 1 4/14/92 TMA
Analytical Parameters	Environmental Data Transmission Numbers[b]	
CLP TAL Inorganics[c]	X01149	X01149
CLP TCL VOCs[d]	X01149	X01149
CLP TCL Semi-VOLs[e]	X01149	X01149
CLP TCL Pest/PCB[f]	X01149	X01149
Radionuclides	X01270	X01270
Wet Chemistry	X01149	X01149

[a] = TMA Norcal
[b] = Environmental Data Transmission (EDT) numbers identify records containing the analytical data
[c] = U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) - e.g., metals and cyanide
[d] = EPA CLP Target Compound List (TCL) of volatile organic compounds (VOC)
[e] = EPA CLP TCL of semi-volatile compounds
[f] = EPA CLP TCL of pesticides and polychlorinated biphenyls (PCB)

Table 3-52 Radionuclides in 100-BC-1 Non-Waste Site Soil Samples and Silica Sand Equipment Blank (concentrations in pCi/g)

Analyte	Soil Samples		Equipment Blank
	B05XZ4^{a}	B05XZ5^{a}	B05XY7^{a}
Gross Alpha	0*(-8.35)^{R}	0*(-7.6)^{R}	0.699^{R}
Gross Beta	10.6^{R}	7.82^{R}	8.06^{J}
Potassium-40	13.56^{J}	13.85^{J}	5.238
Strontium-90	0.209^{J}	0*(-0.341)^{J}	0.225
Radium-226	0.525^{J}	0.8203^{J}	0.1722
Thorium-228	0.6502^{J}	1.179^{J}	0.2422
Thorium-232	1.3^{J}	0.8674^{J}	<0.4858
Uranium-233/234	0.589^{J}	0.621^{J}	0.762
Uranium-235	0.026^{U}	0.0202^{J}	0.0518
Uranium-238	0.634^{J}	0.621^{J}	0.748
Plutonium-238	0^{J}	0.0476^{J}	0.0172^{J}
Plutonium-239	0.004	0.0067	0.0038^{J}
Americium-241	0.012	0	0.0* (-0.008)

^{a} = limited field investigation Data
* = Interpreted as 0, analysis reported as negative concentrations, (-8.35)
^{R} = Value marked as rejected in validation because of missing calibration data
^{U} = Constituent not detected, detection limit shown
^{J} = Value estimated, due to quality control deficiencies

Table 3-53 Electrical Facilities Sample Analysis Matrix

Location	Sample Number	EDT[1] Number - PCB Analysis
181,C2-S1	B018Q6	X01296
183-B,C2-S3	B018Q7	X01296
185-B,E2-S6	B018Q8	X01296
185-B,E2-S7	B018Q9	X01296
190-B-190 AID	B018R0	X01296
B018R0 Split	B018R1	X01296
190-BA, E2-S10	B018R2	X01296
190-C,152 GIC, N. Pad, S.W. Side	B018R3	X01296
190-C,152 GIC, N. Pad, S.E. Side	B018R4	X01296
190-C, C5356F	B018R5	X01296
B018R5 Duplicate	B018R6	X01296
B018R5 Split	B018R7	X01296
190-C, 152 GIC, S. Pad, E. Side	B018R8	X01296
190-C, 152 GIC, S. Pad, S.E. Side	B018R9	X01296
Field Blank	B018S0	X01296
Equipment Blank	B018S1	X01296
C2321, N. Side	B018S2	X01296
C2313	B018S3	X01296
1713-B, E2-S3	B018S4	X01296

Samples collected on 12/09/91
[1] = Environmental Data Transmittal (EDT) Number
PCB = polychlorinated biphenyl

Table 3-54 100-BC-1 and 100-BC-2 Electrical Facility Polychlorinated biphenyl Sampling Results

Location	Sample Number	PCB Concentration (μg/kg)	
		Arochlor-1254	Arochlor-1260
181,C2-S1	B018Q6	U	U
183-B,C2-S3	B018Q7	U	U
185-B,E2-S6	B018Q8	190[JN]	U
185-B,E2-S7	B018Q9	890[JN]	U
190-B-190 AID	B018R0	6,400[JN]	U
B018R0 Split	B018R1	4,700[JN]	U
190-BA, E2-S10	B018R2	U	340[JN]
190-C,152 GIC, N. Pad, S.W. Side	B018R3	U	U
190-C,152 GIC, N. Pad, S.E. Side	B018R4	190[JN]	U
190-C, C5356F	B018R5	420[JN]	U
B018R5 Duplicate	B018R6	U	U
B018R5 Split	B018R7	390	U
190-C, 152 GIC, S. Pad, E. Side	B018R8	500[JN]	U
190-C, 152 GIC, S. Pad, S.E. Side	B018R9	2,700[JN]	U
Field Blank	B018S0	U	U
Equipment Blank	B018S1	U	U
C2321, N. Side	B018S2	U	U
C2313	B018S3	21[JN]	U
1713-B, E2-S3	B018S4	290[JN]	U

U = Indicates nondetection
[JN] = Indicates there is presumptive evidence of the presence of the compound. The concentration reported is considered an estimate which should be used for informational purposes only.
PCB = polychlorinated biphenyl

Table 3-55 Potential Federal Chemical-Specific Applicable or Relevant and Appropriate Requirements for the 100-BC-1 Operable Unit (page 1 of 3)

Description	Citation	A/ R&A*	Requirements	Remarks
Atomic Energy Act of 1954, as amended	42 U.S.C. 2011 et seq.		Authorizes DOE to set standards and restrictions governing facilities used for research, development, and utilization of atomic energy.	
Radiation Protection Standards	40 CFR Part 191		Establishes standards for management and disposal of high-level and transuranic waste and spent nuclear fuel.	
Standards for Management and Storage	40 CFR §191.03	A	Requires that management and storage of spent nuclear fuel or high-level or transuranic radioactive wastes at all facilities for the disposal of such fuel or waste that are operated by the DOE and that are not regulated by the Commission or Agreement States shall be conducted in such a manner as to provide reasonable assurance that the combined annual dose equivalent to any member of the public in the general environment resulting from discharges of radioactive material and direct radiation from such management and storage shall not exceed 25 millirems to the whole body and 75 millirems to any critical organ.	Applicable to wastes disposed of after November 18, 1985.
Nuclear Regulatory Commission Standards for Protection Against Radiation	10 CFR Part 20			
Radiation Dose Standards	10 CFR §§20.101-20.105	R&A	Sets specific radiation doses, levels, and concentrations for restricted and unrestricted areas.	May be relevant and appropriate, as radioactive materials in the 100 Area can contribute radiation doses, levels, and concentrations which could exceed the limits; however, Hanford is not an NRC-licensed facility.

Table 3-55 Potential Federal Chemical-Specific Applicable or Relevant and Appropriate Requirements for the 100-BC-1 Operable Unit (page 3 of 3)

Description	Citation	A/ R&A*	Requirements	Remarks
Uranium Mill Tailings Radiation Control Act of 1978	Public Law 95-604, as amended			
Standards for Uranium and Thorium Mill Tailings	40 CFR 192		Establishes standards for control, cleanup, and management of radioactive materials from inactive uranium processing sites.	
Land Cleanup Standards	40 CFR §§192.10 - 192.12	R&A	Requires remedial actions to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site, the concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than 5 pCi/g, averaged over the first 15 cm of soil below the surface, and 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface. In any habitable building, a reasonable effort shall be made during remediation to achieve an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 Working Level (WL). In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL and the level of gamma radiation shall not exceed the background level by more than 20 microroentegens per hour.	May be relevant and appropriate, as any radium-226 encountered during remediation did not result from uranium processing.
Implementation	40 CFR §§192.20 - 192.23	R&A	Requires that when radionuclides other than radium-226 and its decay products are present in sufficient quantity and concentration to constitute a significant radiation hazard from residual radioactive materials, remedial action shall reduce other residual radioactivity to levels as low as reasonably achievable (ALARA).	May be relevant and appropriate, as any radium-226 encountered during remediation did not result from uranium processing.

*NOTE: A = Applicable, R&A = Relevant and Appropriate

Table 3-56 Potential State Chemical-Specific Applicable or Relevant and Appropriate Requirements for the 100-BC-1 Operable Unit (page 1 of 3)

Description	Citation	A/ R&A*	Requirements	Remarks
Model Toxics Control Act (MTCA)	70.105D RCW		Requires remedial actions to attain a degree of cleanup protective of human health and the environment.	
Cleanup Regulations	WAC 173-340		Establishes cleanup levels and prescribes methods to calculate cleanup levels for soils, groundwater, surface water, and air.	
Groundwater Cleanup Standards	WAC 173-340-720	A	Requires that where the groundwater is a potential source of drinking water, cleanup levels under Method B must be at least as stringent as concentrations established under applicable state and federal laws, including the following: (A) Maximum contaminant levels established under the Safe Drinking Water Act and published in 40 CFR 141, as amended; (B) Maximum contaminant level goals for noncarcinogens established under the Safe Drinking Water Act and published in 40 CFR 141, as amended; (C) Secondary maximum contaminant levels established under the Safe Drinking Water Act and published in 40 CFR 143, as amended; and (D) Maximum contaminant levels established by the state board of health and published in Chapter 248-54 WAC, as amended.	Federal maximum contaminant level goals for drinking water (40 CFR Part 141) and federal secondary drinking water regulation standards (40 CFR Part 143) are potential ARARs under MTCA when they are more stringent than other standards. Method B cleanup levels are levels applicable to remediation at Hanford unless a demonstration can be made that method C (alternate cleanup levels) is valid.

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Table 3-56 Potential State Chemical-Specific Applicable or Relevant and Appropriate Requirements for the 100-BC-1 Operable Unit (page 3 of 3)

Description	Citation	A/ R&A*	Requirements	Remarks
Washington State Department of Health	RCW 43.70			
Radiation Protection -- Air Emissions	WAC 246-247		Establishes procedures for monitoring, control, and reporting of airborne radionuclide emissions.	
New and Modified Sources	WAC 246-247-070	A	Requires the use of best available radionuclide control technology (BARCT),	
Radiation Protection Standards	WAC 246-221		Establishes standards for protection against radiation hazards.	
Radiation dose to individuals in restricted areas	WAC 246-221-010	A	Specifies dose limits to individuals in restricted areas for hands and wrists, ankles and feet of 18.75 rem/quarter and for skin of 7.5 rem/quarter.	

*NOTE: A = Applicable, R&A = Relevant and Appropriate

Table 3-57 Potential Chemical-Specific To-Be-Considered Guidance for the 100-BC-1 Operable Unit (page 1 of 2)

Description	Citation	Requirements	Remarks
Model Toxics Control Act	70.105D RCW		
Cleanup Regulations	WAC 173-340	The State Department of Ecology is currently adapting the calculations in MTCA to be applicable to radioactive contaminants. These cleanup standards may become available prior to or during remediation.	
Solid Waste Disposal Act, as amended by RCRA	42 U.S.C. 6901 et seq.		
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR §257.3-4	A facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary.	The courts or the state may establish alternate boundaries.
Corrective Action for Solid Waste Management Units	40 CFR 264 Subpart S, proposed	Establishes requirements for investigation and corrective action for releases of hazardous waste from solid waste management units.	
U.S. Department of Energy Orders			
Radiation Protection of the Public and the Environment	DOE 5400.5	Establishes radiation protection standards for the public and environment.	
Radiation Dose Limit (All Pathways)	DOE 5400.5, Chapter II, Section 1a	The exposure of the public to radiation sources as a consequence of all routine DOE activities shall not cause, in a year, an effective dose equivalent greater than 100 mrem from all exposure pathways, except under specified circumstances.	Pertinent if remedial activities are "routine DOE activities."
Radiation Dose Limit (Drinking Water Pathway)	DOE 5400.5, Chapter II, Section 1d	Provides a level of protection for persons consuming water from a public drinking water supply operated by DOE so that persons consuming water from the supply shall not receive an effective dose equivalent greater than 4 mrem per year. Combined radium-226 and radium-228 shall not exceed 5×10^{9} µCi/mL and gross alpha activity (including radium-226 but excluding radon and uranium) shall not exceed 1.5×10^{8} µCi/mL.	Pertinent if radionuclides may be released during remediation.

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Table 3-58 Potential Federal Location-Specific Applicable or Relevant and Appropriate Requirements for the 100-BC-1 Operable Unit

Description	Citation	A/ R&A*	Requirements	Remarks
Archaeological and Historical Preservation Act of 1974	16 U.S.C. 469	A	Requires action to recover and preserve artifacts in areas where activity may cause irreparable harm, loss, or destruction of significant artifacts.	Applicable when remedial action threatens significant scientific, prehistorical, historical, or archaeological data.
Endangered Species Act of 1973	16 U.S.C. 1531 et seq.		Prohibits federal agencies from jeopardizing threatened or endangered species or adversely modifying habitats essential to their survival.	
Fish and Wildlife Services List of Endangered and Threatened Wildlife and Plants	50 CFR Parts 17, 222, 225, 226, 227, 402, 424	A	Requires identification of activities that may affect listed species. Actions must not threaten the continued existence of a listed species or destroy critical habitat.	Requires consultation with the Fish and Wildlife Service to determine if threatened or endangered species could be impacted by activity.
Historic Sites, Buildings, and Antiquities Act	16 U.S.C. 461	A	Establishes requirements for preservation of historic sites, buildings, or objects of national significance. Undesirable impacts to such resources must be mitigated.	
National Historic Preservation Act of 1966, as amended.	16 U.S.C. 470 et seq.	A	Prohibits impacts on cultural resources. Where impacts are unavoidable, requires impact mitigation through design and data recovery.	Applicable to properties listed in the National Register of Historic Places, or eligible for such listing. B reactor is listed on the Register.
Wild and Scenic Rivers Act	16 U.S.C 1271	A	Prohibits federal agencies from recommending authorization of any water resource project that would have a direct and adverse effect on the values for which a river was designated as a wild and scenic river or included as a study area.	The Hanford Reach of the Columbia River is under study for inclusion as a wild and scenic river.

*NOTE: A = Applicable, R&A = Relevant and Appropriate

Table 3-59 Potential State Location-Specific Applicable or Relevant and Appropriate Requirements for the 100-BC-1 Operable Unit

Description	Citation	A/ R&A*	Requirements	Remarks
Habitat Buffer Zone for Bald Eagle Rules	RCW 77.12.655			
Bald Eagle Protection Rules	WAC 232-12-292	A	Prescribes action to protect bald eagle habitat, such as nesting or roost sites, through the development of a site management plan.	Applicable if the areas of remedial activities includes bald eagle habitat.
Regulating the Taking or Possessing of Game	RCW 77.12.040			
Endangered, Threatened, or Sensitive Wildlife Species Classification	WAC 232-12-297	A	Prescribes action to protect wildlife classified as endangered, threatened, or sensitive, through development of a site management plan.	Applicable if wildlife classified as endangered, threatened, or sensitive are present in areas impacted by remedial activities.

*NOTE: A = Applicable, R&A = Relevant and Appropriate

Table 3-60 Potential Location-Specific To-Be-Considered Guidance for the 100-BC-1 Operable Unit

Description	Citation	Requirements	Remarks
Floodplains/Wetlands Environmental Review	10 CFR Part 1022	Requires federal agencies to avoid, to the extent possible, adverse effects associated with the development of a floodplain or the destruction or loss of wetlands.	Pertinent if remedial activities take place in a floodplain or wetlands.
Protection and Enhancement of the Cultural Environment	Executive Order 11593	Provides direction to federal agencies to preserve, restore, and maintain cultural resources.	Pertains to sites, structures, and objects of historical, archeological, or architectural significance.
Hanford Reach Study Act	PL 100-605	Provides for a comprehensive river conservation study. Prohibits the construction of any dam, channel, or navigation project by a federal agency for 8 years after enactment. New federal and non-federal projects and activities are required, to the extent practicable, to minimize direct and adverse effects on the values for which the river is under study and to utilize existing structures.	This law was enacted November 4, 1988.

4.0 QUALITATIVE RISK ASSESSMENT

This chapter provides a summary of the QRA that was performed for the high-priority waste sites in the 100-BC-1 Operable Unit. Complete results of the QRA are provided in the *Qualitative Risk Assessment of the 100-BC-1 Source Operable Unit* (WHC 1993a).

4.1 QUALITATIVE RISK ASSESSMENT PROCESS

The QRA is an evaluation of risk for a predefined set of human and ecological exposure scenarios. The QRA is not intended to replace or be a substitute for a baseline risk assessment. Consequently, the QRA is streamlined to consider only two human health scenarios (frequent- and occasional-use) with four pathways (soil ingestion, fugitive dust inhalation, inhalation of volatile organics, and external radiation exposure) and a limited ecological evaluation. These scenarios and pathways were agreed to by the 100 Area Tri-Party Unit Managers (December 21, 1992, and February 8, 1993). In addition, the decay of radionuclides to the year 2018 and shielding provided by current soil and gravel covers from gamma-emitting radionuclides are considered.

4.1.1 Approach

The QRA was conducted using HSBRAM (DOE-RL 1993a) and consisted of:

- an evaluation of the data and data sources
- a comparison of site data to Hanford background data
- a human health evaluation
- an ecological evaluation.

Key factors that contributed to uncertainty in the risk assessment process were also identified. A summary of the available data and the level of confidence in that data are provided in Table 4-1.

4.1.2 Assumptions Used in the Qualitative Risk Assessment

The following assumptions were agreed to by the Tri-Party Unit Managers prior to performing the QRA:

- Sitewide soil background data was used to screen inorganics.
- Organics and radionuclides were not compared to background values.
- Historical radionuclide concentrations were decayed to 1992.

- The maximum contaminant concentration within the upper 15 ft (4.6 m) of soil, either from historical or LFI data, was evaluated in the QRA.

- Two scenarios, frequent use and occasional use, were evaluated in the human health section of the QRA.

- For the human health exposure assessment, the pathways evaluated in the QRA were: soil ingestion, fugitive dust inhalation, inhalation of volatile organics, and external radiation exposure.

- Ecological scenarios were evaluated using the Great Basin pocket mouse because it is a biological endpoint with a range similar in size to the individual waste management units.

Several other assumptions were made in the QRA. The data collection during the LFI for the operable unit followed a known process and therefore the data are considered to be high-quality. Whereas historical data (e.g., Dorian and Richards 1978) were considered medium-quality because the data were not validated and documentation was less rigorous. Where historical data do not specify uranium isotopes, ^{238}U is assumed. Chromium was assumed to be Cr (VI) because it provides the most conservative evaluation and was the form used at most sites (e.g., sodium dichromate). Nickel in the soil environment was not considered carcinogenic because the pyrolytic activity which generates the carcinogenic form of Ni was not present in the operable unit. If toxicity factors were not available for a constituent, surrogate factors were generally not used, unless specifically noted. The qualitative risk estimations are grouped into high (incremental cancer risk [ICR] > 1E-02), medium (ICR > 1E-04 to 1E-02), low (ICR 1E-06 to 1E-04), and very low (< 1E-06) risk categories.

For the ecological risk assessment, metals were assumed to be bioavailable for uptake by vegetation. The identified concentrations were assumed to be uniformly distributed over the site, biologically active, and available for transport into the biosphere. Hazard quotients for ecological exposure to radionuclides were based on an exposure limit of 1 rad/day (DOE Order 5400.5) and the lowest observable effect level (LOEL) dose.

4.2 HUMAN HEALTH QUALITATIVE RISK ASSESSMENT

The QRA provides estimates of risk that might occur under frequent-use or occasional-use based on the best available knowledge of current contaminant conditions, but does not represent actual risks since neither frequent-use nor occasional-use of the high-priority site currently occurs.

4.2.1 Overview of the Human Health Risk Evaluation Process

The frequent-use and occasional-use scenarios are evaluated using residential and recreational assumptions in the HSBRAM (DOE-RL 1993a), respectively. Frequent-use is addressed for current (1992) and future (2018) contaminant concentrations. Air inhalation of volatile organics was eliminated from this analysis because there were not significant concentrations of volatile organics in the soil. Therefore, inhalation of volatile organics was not a likely pathway for this operable unit. For the soil ingestion and external exposure pathways, maximum sample concentrations from the upper 15 ft of the soil were used. For the air inhalation pathways, maximum contaminant concentrations in the upper 15 ft of soil were used in conjunction with a particulate emission factor. This factor relates contaminant concentrations in the soil to concentrations of respirable particles in the air due to fugitive dust emissions. External exposure slope factors provided by EPA are based on uniform contaminant distribution, infinite in depth and areal extent (i.e., an infinite slab source). For high-energy gamma emitters (e.g., ^{60}Co and ^{137}Cs), the assumption of an infinite slab source is satisfied if radionuclides extend to nearly 2 m (6.6 ft) below ground surface, and over a distance of a few hundred meters or more. If the site being evaluated is smaller than this, or if the site has a clean soil cover, then use of external exposure slope factors is likely to provide risk estimates that may be unrealistic. For this reason, the results of the occasional-use scenario also indicate whether or not the radionuclides are present in the upper 2 m and a comparison to site-monitoring data is presented. Quantification of exposures was conducted using Section 2.3 of the HSBRAM (DOE-RL 1993a).

Risk characterization for the individual waste sites differed depending on the type and amount of data available for the specific waste site. Risk characterization is conducted in accordance with Section 2.4 of the HSBRAM (DOE-RL 1993a). The risk characterization for each site was performed by calculating contaminant-specific ICRs and hazard quotients (HQs) and then calculating site-specific risks using contaminant-specific risks.

For sites where sampling data were not available to calculate ICRs and HQs, the risk characterization consisted of only a qualitative discussion of the site, the potential threat posed by the site, and the confidence in the information available to assess the threat. Data from analogous sites were used, where appropriate, to qualitatively determine possible contaminants and potential risk levels. The basic intake equations presented in Appendix C of the 100-BC-1 QRA (WHC 1993a) were modified to identify concentrations in the soil associated with an ICR of 1E-06 or HQ of 1, using HSBRAM exposure parameters.

4.2.2 Results of the Human Health QRA

An overview of the human health QRA and uncertainties for the 100-BC-1 QRA (WHC 1993a) are summarized in the following sections.

Information summarized in Tables 4-2 and 4-3 for the human health QRA includes:

- the qualitative risk estimation
- the risk driving contaminants for the frequent-use and occasional-use scenarios
- the risk driving pathways for the frequent-use and occasional-use scenarios.

The risk-driving contaminants for both the frequent-use and occasional-use scenarios are generally radionuclides and the risk-driving pathway is usually the external exposure pathway, as shown in Table 4-3.

The high-priority waste sites listed in Table 4-2 of the 100-BC-1 Work Plan (DOE-RL 1992a) are evaluated in the QRA. Where, LFI data was not collected historical data were used in the risk assessment. Where no other information was available analogous waste sites were considered in evaluating the potential risk from the waste site.

Based on the QRA, the high-priority waste sites within the 100-BC-1 Operable Unit are grouped into high, medium, low, and very low risk categories as shown in Table 4-3. The results of the frequent-use scenarios are summarized as follows:

- The waste sites that are considered high risk for the frequent-use scenario in 1992 are 116-B-1, 116-C-5, 116-C-1, 116-B-11, process effluent pipelines (sludge), and 116-B-4.

- The waste sites that are considered high risk for the frequent-use scenario in 2018 are 116-C-5, 116-B-11, process effluent pipelines (sludge) and 116-B-4.

- The waste sites that are considered medium risk for the frequent-use scenario in 1992 are 116-B-2, 116-B-3, 116-B-5, and process effluent pipelines (soil).

- The waste sites that are considered medium risk for the frequent-use scenario in 2018 are 116-B-1, 116-B-2, 116-B-3, 116-C-1, and process effluent pipelines (soil).

The results of the occasional-use scenarios are summarized as follows:

- The waste sites that are considered high risk for the occasional-use scenario are process effluent pipelines (sludge) and 116-B-11. Gamma-emitting radionuclides are present in the upper 2 m and surface contamination is evident at 116-B-11.

- The waste sites that are considered medium risk for the occasional-use scenario are 116-C-5, 116-C-1, and 116-B-4. Gamma-emitting radionuclides are present in the upper 2 m at 116-C-5 and 116-B-4. Surface contamination is evident at 116-C-5 and 116-C-1.

Other results of the QRA as presented in Tables 4-2 and 4-3 are:

- The radionuclides are identified as the main contributors to the overall risks via the external exposure pathway. The specific radionuclides identified as key contributors are ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{154}Eu.

- There are several sites where potential contaminants are identified only on the basis of historical information and no concentrations of contaminants are known. These sites are 116-B-9, 116-B-10, 116-B-12, 118-B-5, 118-B-7, 116-B-13/116-B-14, 116-B-7/132-B-6/132-C-2 and 116-B-6A. Concentrations at which an ICR of 1E-06 or HQ of 1.0 would exist are calculated for the potential contaminants. Estimated risks are considered qualitative estimates and are based on suspected risk-driving contaminants, disposal information and size of the waste site.

- There are also several sites in which very little or no data are available to evaluate the waste site with either risk estimates or risk-based concentrations. These sites are 118-B-10, 128-B-3, and 126-B-2.

The risks, both carcinogenic and non-carcinogenic, presented in this QRA are deterministic estimates. Consequently, given the multiple assumptions about exposure, toxicity, and variables uncertainty exists for the evaluation of the contaminants, the exposures, the toxicities and the risk characterization for the QRA. This uncertainty is discussed more extensively in the following sections.

4.2.3 Summary of Key Uncertainties in the Human Health Risk Assessment

In general, the QRA is based on a limited data set. There is uncertainty because collected samples may not be representative of the waste site and historical data may not accurately represent current conditions. Because the samples may not be completely representative of the site, risks may be underestimated or overestimated.

There is uncertainty with respect to identification of specific contaminants. Where the isotope of uranium is not specified uranium is evaluated as ^{238}U. The slope factors for the uranium isotopes differ slightly from one another and would result in slightly different risks if each were evaluated. The valence state of Cr in soils was not known. For the QRA, the most toxic form was assumed. However, risks may be overestimated if Cr exists as the less toxic form.

Uncertainty is associated with the toxicity values, the toxicity information available to assess potential adverse effects, and the interpretation of the toxicity data. This uncertainty in the information and the lack of specific toxicity information contribute to uncertainty in the toxicity assessment.

When there is a high degree of uncertainty associated with the information used to derive a toxicity value, there is less confidence in the assessment of the risk associated with exposure, or vice versa. The primary source of these uncertainties include the following:

- Information on dose-response effects from high-dose exposure scenarios is used to predict effect at low-dose exposure scenarios.

- Animal dose-response data are used to predict effects in humans.

- Short-term exposure data are used to extrapolate from long-term, or vice versa.

- Dose-response information from a homogeneous animal or healthy human population are used to predict the effects that may occur in the general population where there are varying sensitivities to different contaminants.

U.S. Environmental Protection Agency slope factors developed to assess external exposures to radionuclides are likely to be particularly conservative because they are only appropriate when contaminant conditions can be represented by an infinite slab source method cover (EPA 1992).

Historical information and analogous-site data were used to evaluate some of the high-priority waste sites. The selection of analogous sites for the QRA are based on available information at the time the QRA was prepared. As additional information is identified and incorporated into the LFI report for the 100-BC-1 Operable Unit, the QRA should be updated to utilize additional pertinent information.

4.3 ECOLOGICAL QUALITATIVE RISK ASSESSMENT

The purpose of the qualitative ecological risk assessment is to estimate the ecological risks from existing contaminant concentrations in the 100-BC-1 Operable Unit to selected ecological receptors.

The 100-BC-1 Operable Unit is a terrestrial waste unit. The approach consistent with the objective of the QRA is to assess the dose to the Great Basin pocket mouse. The mouse is used as the indicator receptor because its home range is comparable to the size of most waste sites and will receive most of its dose from a waste site. This allows a risk comparison between waste sites. A secondary receptor, the loggerhead shrike is also evaluated to provide an operable unit assessment of risk. The shrike is a raptor and represents an organism at a different trophic level and greater spatial scale than the mouse and provides an operable unit wide risk estimate.

Ecological Effects. Contaminants found in the soil at waste sites within the 100-BC-1 Operable Unit include radioactive and non-radioactive elements. For nonradioactive elements, ecological effects were evaluated from uptake from the soil by plants, and by accumulation of these elements through the foodweb. Radioactive elements have ecological effects resulting from their presence in the abiotic environment (external dose), and from ingestion (e.g., dose from contaminated food consumption), resulting in a total body burden. Total daily doses to an organism can be estimated as the sum of doses (weighted by energy of radiation) received from all radioactive elements ingested, residing in the body, and available in the organism's environment. Radiological dose calculation methodology as reviewed by Baker and Soldat (1992), were applied in this QRA.

The radiological dose an organism receives is usually expressed as rad/day. Exposure can result from both external environmental radiation and internal radiation from body burden. All exposure pathways are added in determining total organism dose. Internal exposure includes both body burden (contaminants that are taken into the body from all pathways) and dose from recent food consumption which is still in the gut.

Endpoint Selection. The assessment and measurement endpoint is the health and mortality of the Great Basin pocket mouse, respectively. This is consistent with the objective of the qualitative ecological risk assessment. The dose to the pocket mouse was used to screen the level of risk of an individual waste site. For radionuclides, mouse dose is compared to 1 rad/day (Order DOE 5400.5) (IAEA 1992). For non-radiological contaminants, dose is compared to toxicity values. In addition, to provide a more global perspective of risk for the 100-BC-1 Operable Unit, a secondary endpoint is the health of the loggerhead shrike and the measured endpoint is mortality. The focus of this study is at the individual level of ecological organization.

Risk is evaluated for the Great Basin pocket mouse based on a two-step accumulation model operated on a waste-site-by-waste-site basis, since each waste site approximates the size of the Great Basin pocket mouse home range. Risk is also estimated for the loggerhead shrike on the basis of a three-step accumulation model that is integrated over all of the 100-BC-1 Operable Unit waste sites. The method of integration is based on averaging waste site constituent concentrations over the operable unit as a fraction of the total operable unit area.

Exposure Analysis. The purpose of the exposure analysis is to integrate the spatial and temporal distributions of the ecological components and stressors to evaluate exposure. Two exposure scenarios were evaluated, the maximum observed concentration at 0 to 15 ft and the maximum observed concentration at 0 to 6 ft. The former scenario is for compliance with the MTCA and the latter provides an ecologically relevant exposure.

All non-radioactive and radioactive constituents identified as of potential concern in the human health risk assessment (before the screening of constituents with the greatest human health risk) were considered to be of concern in the ecological risk assessment. Because of the lack of site-specific data other than soil, it was assumed the receptor spends some fraction of it's life in the site, obtains all its food from the site when present, and all consumed food is contaminated. However, because there is no source of water within the site, drinking water was not considered a route of exposure.

For non-radiological constituents, concentrations estimated in mice were compared to the reported benchmark or potentially toxic concentrations. For radiological constituents, mice concentrations were converted to dose. Total dose for all radionuclides are compared to published effect levels and regulatory standards where available.

Exposure Profile. The ecological risk assessment focuses on potential noncarcinogenic effects on the Great Basin pocket mouse potentially exposed to constituents present in the 100-BC-1 Operable Unit waste sites. Terrestrial vegetation is represented as a generic plant species for uptake from the soil and as a food source for mice.

The major route of contaminants to plants is assumed to be direct uptake from soil. Ingestion of vegetation is assumed to be a major route of exposure to the mouse and ingestion of mice and insects is the major route for the shrike, for both non-radiological and radiological constituents. For radionuclides, the exposure pathway considered uptake from contaminated food resulting in internal exposure. For both radiological and non-radiological contaminants, the dose is based on receptor whole-body concentrations. Metals stressors are assumed to be bioavailable for uptake by vegetation, which is consistent with the objectives of the QRA.

4.3.1 Results of the Ecological Evaluation

A qualitative ecological risk assessment was completed for the 100-BC-1 Operable Unit. Most of the maximum contaminant concentrations detected were from the upper 6 ft of soil. Only site 116-C-5 exceeded the 1 rad/day with an environmental hazard quotient (EHQ) >1. Routine surveying of surface soil contamination in the 116-C-5 site showed beta levels which indicated surface contamination. For non-radiological constituents, site 116-B-5 exceeded the no observable effects level (NOEL) for Ba and Hg, and site 116-C-5 exceeded the wildlife NOEL for Cr, Hg, Pb, Sb, and pentachlorophenol.

For waste sites with only historical data, site 116-B-11, the process effluent pipelines (diversion and junction box samples), and site 132-B-4/132-B-5 filter building/gas recirculating building exceeded the 1 rad/day benchmark. For 116-B-11, routine soil surveys showed beta activity which indicated surface contamination. For non-radiological constituents, site 116-B-5 exceeded wildlife NOELs for Ba and Hg. The dose to loggerhead shrike was calculated for ^{90}Sr since it is the major risk driver. Dose was estimated at the operable unit level. Dose to the shrike from ^{90}Sr from the mouse diet exceeds the 1 rad/day benchmark.

Other results of the QRA as presented in Tables 4.4 and 4.5 are:

For sites that exceeded the radionuclide 1 rad/d benchmark, all of the dose is from ^{90}Sr.

The estimated dose from ^{90}Sr to the loggerhead shrike exceeded 1 rad/day from all waste sites that had measurable ^{90}Sr at the 100-BC-1 Operable Unit (Table 4-5 of the QRA). This extremely high calculated dose is believed to be an artifact of the modeling parameters (e.g., source term) and does not reflect actual conditions. The significance of dose estimates, either radiological or hazardous chemicals, as the risk driver is governed by the accuracy of the source terms. If the source of ^{90}Sr is 10 feet below the surface, the dose may not represent real ecological risk since the exposure scenario is unrealistic. The approach in the QRA is to use the maximum level of contamination which drives the QRA far into the conservative side and makes the results useful only for comparison between waste sites.

Yearly radiological surface soil surveys have been conducted in the 100 B/C Area (Schmidt et al. 1992). Results from 1981 to 1991 for selected radionuclides have shown only low soil concentrations. Strontium-90, which is the major mouse and shrike risk driver, has been monitored in surface soils since 1984. Yearly averages for soil and vegetation for the B/C Area during 1991 are shown summarized in Table 4-6 of the QRA (WHC 1993a). Strontium concentration is 0.19 pCi/g in soil and 0.083 pCi/g for vegetation. These concentrations are orders of magnitude lower than the source term concentrations where risk is found to the Great Basin pocket mouse and shrike, again suggesting that the reality of the risk characterization is driven by the source term.

4.3.2 Summary of Key Uncertainties in the Ecological Evaluation

The uncertainty in contaminant concentrations for the ecological evaluation is related to the accuracy of the data. For the QRA, uncertainty exists in both contaminants identified and exposure concentrations. As for the human health assessment, the maximum contaminant concentration was used.

The QRA models the potential exposure of wildlife thought present in or near the waste site. The issues of concern with regard to ecological risk assessment (particularly qualitative) are the uncertainties in using an assortment of environmental variables in risk modeling. This begins with the source term. If this number is not realistic, no amount of modeling will overcome this deficiency. For example, in the case of the QRAs, the maximum reported waste concentration was used as the source term no matter how deep this concentration.

Generally, site specific organisms (e.g., pocket mouse), are identified as being associated with a site, but little if any data may exist concerning transfer of contaminants to site specific organisms. Often, it is necessary to use biological trophic transfer information for related species.

A significant source of uncertainty in the exposure scenario is that the waste site is uniformly contaminated and in the case of the mouse, all foodstuff is assumed to be contaminated. No provision is made for dilution of contaminated foodstuff by noncontaminated foodstuff. It was also assumed contaminants were not passed through the gut but completely retained (100% absorption efficiency).

To complete the QRA for the 100-BC-1 Operable Unit it was necessary to use data from surrogate organisms in place of the pocket mouse and shrike since no site data is available for these organisms. This contributes to overall QRA uncertainty. In addition, transfer coefficients used to model uptake of contaminants from soil to plants were not Hanford specific, the approach did not consider whether roots of a plant actually grow deep enough to contact a contaminant, and the model did not account for reduced concentrations from plant to seed (it was assumed the seed concentration was the same as the plant). For the pocket mouse the food consumption rate was generalized and seasonal behavior (hibernation) that would reduce exposure and body burden was not considered. In the case of the shrike, the percent diet contribution of the pocket mouse or insects to total diet is not known. The risks developed in the QRA are not actual risks but estimates of potential risk under high-frequency use.

Uncertainty associated with wildlife toxicity values is significant, particularly for non-radiological contaminants. The approach used in the QRA tends to build conservatism into the toxicity value.

Table 4-1 Summary of Data Availability and Data Confidence (for sites where data are available)

Waste Site	Summary of Data Availability and Data Confidence					
	Historical Data[a]	LFI Data[a]	Information from a Related or Analogous Site[a]	Data from the same Medium[b]	Confidence in Contaminant Identification	Confidence in Contaminant Concentrations
Sites with LFI data						
116-B-1	R	R,I		Yes	high	high to med.
116-B-2	R	R,I,O		Yes	high	high to med.
116-B-3	R	R,I,O			high	high to med.
116-B-5	R	R,I,O		Yes	high	high to med.
116-C-5	R	R,I,O		Yes	high	high to med.
Sites with Historical Data and Analogous Site Information						
116-C-1	R		R		medium	medium
116-B-11	R		R	Yes	medium	medium
Process Pipe (sludge)	R		R		medium	medium
Process Pipe (soil)	R		R	Yes	medium	medium
116-B-4	R		R	Yes	medium	medium
Sites with Historical Data						
116-B-6B	R			Yes	medium	medium
132-B-4 / 132-B-5	R				medium	medium

- = Not applicable
[a] R = radionuclide, I = inorganic, O = organic contaminant
[b] limited field investigation (LFI) and Historical Data are from the same medium (e.g., both from soil) or from different media (e.g., soil and sludge)

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Table 4-2 Human Health Data and Risk Assessment Summary (for sites where only process knowledge is available) (page 1 of 2)

Site	Disposal Information	Suspected Risk-Driving Contaminants	Description and Notes	Qualitative Risk Rating[a]	Rationale for Rating
116-B-9	Used from 1952 - 1954; 40,000 ℓ of waste water from the P-10 storage building	Hg	French drain size = 1.2 m x 1.2 m x 0.9 m	low	No radionuclides suspected, small site size
116-B-10	Used from 1950 -1968; 5 million ℓ of liquid decontamination waste from 108-B Tube examination and experimental facility	Cr Cs-137 Co-60 Eu-152 Eu-154	Dry well size = 0.9 m x 0.9 m x 2 m	medium	Radionuclides present; large amount of liquid disposed over 18 years. Radiation levels are generally below background.
116-B-12	Unknown waste volumes of drainage from the confinement system seal pits in the 117-B building	Sb Cr Cs-137 Sr-90	Crib size=3 m x 3 m x 3 m	medium	Radionuclides present, small site size
118-B-5	40 m^3 of highly contaminated reactor components	Co-60 Ni-63	Ball 3x burial ground size = 15 m x 15 m x 6 m	low	Waste is buried under approximately 1.5 m of clean soil
118-B-7	Unknown amounts of solid waste from the 111-B facility	Co-60 Ni-63	Solid waste burial ground size = 2 m x 2 m x 2 m	low	Waste is decontamination materials and associated equipment, small site size
116-B-13, 116-B-14	Received sludge from 116-B-11 retention basin	Cs-137 Co-60 Eu-152 Eu-154 Ni-63 Pu-238 Pu-239 Sr-90	No historical data available but composition of sludge in these trenches is probably similar to the sludge remaining in 116-B-11 and 116-C-5 basin. 116-B-13 size = 15m x 15m x 3m 116-B-14 size = 37m x 3m x 3m	medium	Assume that the sludge is buried under 2m of clean soil
116-B-7, 132-B-6, and 132-C-2	Used from 1944-1969 to transport cooling water and process sewer water to the Columbia River	Cr Sr-90	Suspected contaminants based on analogous site information, 116-B-7 and 132-B-6 size = 8.2 m x 4.2 m x 6.4 m , 132-C-2 size = 8.2 m x 16 m x 6.4 m	medium	Contaminants may remain in outfall pipes; large volumes of effluent; radiological survey of 132-B-6 and 132-C-2 indicated presence of radiation above background levels.

Table 4-2 Human Health Data and Risk Assessment Summary
(for sites where only process knowledge is available) (page 2 of 2)

Site	Disposal Information	Suspected Risk-Driving Contaminants	Description and Notes	Qualitative Risk Rating[a]	Rationale for Rating
116-B-6A	Received decontamination waste from 111-B-area	Cs-137 Co-60 Sr-90	The crib was treated by in-situ vitrification and remaining waste is in solid matrix mass	low	The vitrified mass is buried under 1.8m of soil.
118-B-10	No information available			high	Most conservative estimated used
128-B-3	No information available			low	Used as a burn pit and dump site
126-B-2	None	None	Clearwell size = 38 million ℓ capacity	low	No known contaminants associated with the site

[a] Rating is qualitative based on process information, analogous site information, and site-specific information such as size, potential contaminants, and location of contamination as indicated under rationale column. Additional discussion on the rating is provided for each site in the 100-BC-1 Qualitative Risk Assessment (QRA) (WHC 1993a).

Table 4-3 Human Health Risk Assessment Summary (for sites where data are available)

Waste Site	Human Health Risk Assessment Summary				
	Frequent-Use Scenario			Occasional-Use Scenario	
	Qualitative Risk Estimation		Risk Driving Contaminant[a] (and pathway[c])	Qualitative Risk Estimation	Risk Driving Contaminant[a] (and pathway[c])
	1992	2018			
Sites with LFI data					
116-B-1	high	medium	R(O,I,E) I(I)	low	R[d,e] (E)
116-B-2	medium	medium	R(O,I,E)	low	R[d] (E)
116-B-3	medium	medium	R(O,E) I(O,I)	low	R[d,e] (E)
116-B-5	medium	low	R[d] (O,E)[e]	low	R[d] (E)
116-C-5	high	high	R(O,I,E) I(O,I)	medium	R(O,I,E) I(I)
Sites with Historical Data and Analogous Site Information					
116-C-1	high	medium	R(O,I,E)[f]	medium	R[e] (E)
116-B-11	high	high	R(O,I,E)	high	R(O,I,E)
Process Pipe (sludge)	high	high	R(O,I,E)	high	R(O,I,E)
Process Pipe (soil)	medium	medium	R(E)	low	R(E)
116-B-4	high	high	R(O,I,E)	medium	R[d](E)
Sites with Historical Data					
116-B-6B	low	low	R[d](E)	very low	
132-B-4/132-B-5	low	low	R[d](O)	very low	

- = Not applicable

[a] R = radionuclide, I = inorganic, O = organic contaminant

[b] limited field investigation and Historical Data are from the same medium (e.g., both from soil) or from different media (e.g., soil and sludge)

[c] O = oral, I = inhalation, E = external exposure pathways

[d] Radionuclides contributing >1E-06 to the risk have half-lives of 30 years or less

[e] Only the external exposure pathway has the risk driving contaminants for 2018.

[f] Only external exposure and soil ingestion pathways have the risk driving contaminants for 2018.

[g] Contaminants not detected in upper 2 m of soil.

Table 4-4 Environmental Hazard Quotients Summary for Radionuclides by Waste Site

Waste Site	Dose Rate Exceeds EHQ of 1
116-B-1 Liquid Waste Disposal Trench	no
116-B-2 Storage Basin Trench	no
116-B-3 Pluto Crib	no
116-B-5 Crib	no
116-C-5 Retention Basin	yes
116-C-1 Liquid Waste Disposal Trench	no
116-B-11 Retention Basin	yes
Process Effluent Pipelines (sludge)	yes
Process Effluent Pipelines (soil)	no
Process Effluent Pipelines (soils)	no
116-B-4 Dummy Decontamination French Drain	no
116-B-6B Crib	no
132-B-5 (115) Gas Recirculation Building	yes

EHQ - environmental hazard quotient

Table 4-5 Environmental Hazard Quotient Summary for Non-radiological Contaminants by Waste Site

Site	Contaminant	Dose Rate Exceeds EHQ of 1
116-B-1 Liquid Waste Disposal Trench	Chromium	no
116-B-3 Pluto Crib	Chromium	no
	Benzo(a)pyrene	no data
	Chrysene	no data
116-B-5 Crib	Barium	yes
	Mercury	yes
116-C-5 Retention Basin	Antimony	yes
	Chromium	yes
	Lead	yes
	Mercury	yes
	Chrysene	no data
	Pentachlorophenol	yes
Process Effluent Pipeline Soils	Chromium	no

EHQ - environmental hazard quotient

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5.0 RECOMMENDATIONS

The primary purpose of the LFI report is to recommend those high-priority sites that should remain candidates on the IRM path and those high-priority sites which should not remain candidates for the IRM path. Sites that are not recommended as candidates for an IRM will be addressed in the final remedy selection process. These recommendations are generally independent of future land-use scenarios.

5.1 GENERAL CONSIDERATIONS

Analyses of LFI samples from high-priority sites did not detect any pesticides or PCBs and only low levels of VOCs were found. Contamination by PCBs in surface soil samples was found at many electrical facilities in the 100-BC-1 and 100-BC-2 Operable Units. Because these facilities are not high-priority sites, they are not addressed as IRM candidates. Although the VOCs are most likely the result of contamination present in the analytical laboratories, the VOC concentration data were evaluated in the QRA and are predicted to pose no human health risk. The detected semi-volatile compounds include typical constituents in creosote and other wood preservatives. These semi-volatile compounds were detected in concentrations below the EPA CLP contract-required quantitation limits. Timbers used to construct the cribs and the wood baffles in the retention basins may be sources for these compounds. Contamination by metals was found at 116-B-1, 116-B-3, 116-B-5, and at the highest concentrations in the 116-C-5 sludge. Radionuclide contamination was also greatest in the 116-C-5 sludge, and present in all other sampled high-priority waste sites. The radionuclides ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{154}Eu are the main contributors to overall risk via external exposure. Metals also contribute to elevated risks at the 116-C-5 retention basin.

None of the sites pose an imminent threat to human health or the environment, or pose risks sufficient to warrant an ERA. The evaluation of sites is presented in the following sections.

5.2 HIGH-PRIORITY SITE IRM CANDIDATE EVALUATION CRITERIA

The 100-BC-1 high-priority sites were evaluated using the following criteria to identify those sites where continued IRM candidacy is recommended:

- the 100-BC-1 QRA (WHC 1993a)
- an assessment of the waste site conceptual model
- identification of any ARARs exceedance for vadose zone contaminants
- an evaluation of site-specific contaminant impact on groundwater

- identification of sites where natural attenuation by the year 2018 may reduce risks and mitigate contamination.

5.2.1 Qualitative Risk Assessment

The QRA provides risk estimates for human health and for adverse ecological effects. Human health risks, specifically ICR, for the high-priority sites were developed in the QRA using two scenarios: high-frequency use and low-frequency use. The low-frequency use risk values are used to evaluate the continued candidacy of high-priority sites for IRMs. The qualitative risk estimations presented in Table 5-3 are grouped into high (ICR > 1E-02), medium (ICR > 1E-04 to 1E-02), low (ICR 1E-06 to 1E-04), and very low (ICR < 1E-06) risk categories based on results presented in Chapter 3 of the 100-BC-1 QRA (WHC 1993a). Sites that pose medium or high risks to human health under the low-frequency use scenario are recommended to continue as IRM candidates.

Environmental hazard quotient ratings are from the qualitative ecological risk assessment that was performed in the QRA. Sites that have an EHQ rating >1 for radionuclides or nonradiological constituents present potentially adverse ecological impact and are recommended to continue as IRM candidates.

5.2.2 Conceptual Model

The conceptual model for the waste site includes sources of contamination, types of contaminants, nature and extent of contamination in each affected media, known and potential routes of migration, known or potential human and environmental receptors, and the general understanding of the site structure/process. This information is included in Chapter 3 of the 100-BC-1 Work Plan (DOE-RL 1992a) and has been revised using data obtained during the LFI. Table 5-1 presents sources of contamination, types of contaminants, nature and extent of contamination in each affected media, and the general understanding of the structure/process for each high-priority waste site. Figure 5-1 presents the known and potential routes of migration, known or potential human and environmental receptors for the operable unit. If the conceptual model of a site is incomplete, the site is recommended to remain as an IRM candidate while the data needed to complete the model are collected. After the data are available the site will be reevaluated for continued candidacy for an IRM. The additional data may be obtained through limited field sampling.

5.2.3 Applicable or Relevant and Appropriate Requirements

The Washington State MTCA Method B concentrations are potential ARARs for soil contamination, as discussed in Section 3.25 of this report and in the *100 Area Feasibility Study, Phases 1 and 2* (DOE-RL 1992e). Model Toxics Control Act Method B regulatory limits for soil contaminant concentrations are utilized since they are the standard approach and are conservative. Table 5-2 lists the Hanford Site background 95% UTL values for metallic constituents in soils and MTCA Method B guidelines for soil. Sites that have concentrations of contaminants which exceed this potential chemical-specific ARAR are recommended to continue as IRM candidates.

5.2.4 Current Impact on Groundwater

The probability of current impact on groundwater is evaluated for each site by comparing groundwater contaminant concentrations from monitoring wells located upgradient and downgradient of each specific site, where wells are available. Concentrations of ^{3}H, ^{90}Sr, and ^{99}Tc in upgradient and downgradient wells are compared. Groundwater contaminant concentrations in a downgradient well that are higher than in an upgradient well indicate current impact to groundwater. Sites that are impacting groundwater are recommended to continue as IRM candidates.

5.2.5 Potential for Natural Attenuation

The potential for the contaminants at a site to be reduced by natural attenuation, i.e., radioactive decay by the year 2018, may be a consideration at sites where radionuclides with half lives less than 30 years are the primary contaminant and external exposure is the only pathway. Sites with excess risk attributed to radionuclides with half lives less than 30 years, i.e., ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{154}Eu, have potential for natural reduction of risk through radioactive decay. Natural attenuation is not a consideration for sites contaminated by metals, by radionuclides with half-lives greater than 30 years, or where multiple exposure pathways drive the risk.

5.3 HIGH-PRIORITY SITE IRM CANDIDATE RECOMMENDATIONS

Burial grounds, i.e., sites 118-B-5, 118-B-7, and 118-B-10, are recommended as IRM candidates, as per the HPPS and negotiations with the Tri-Parties. The final selection of IRM sites, priority of action, and order performance are decisions left to the Tri-Party Agreement signatories. Factors that the Tri-Party Agreement signatories may consider in the selection and prioritization of IRM sites include:

- impact of IRM actions in relation to the 100 Area Environmental Impact Statement, e.g., disposition of the reactors
- access control
- relation to the IRM Program Plan recommendations
- land use
- point of compliance
- time of compliance

- feasibility
- bias-for-action, and
- threat to human health and the environment.

Burial grounds are recommended to continue as IRM candidates but are not addressed individually in Table 5-3. The high-priority sites recommended to continue as IRM candidates are identified in the "IRM Candidate" column of the Table 5-3. The recommendations are discussed below.

5.3.1 116-B-1 Liquid Waste Trench

The 116-B-1 liquid waste trench is recommended to continue as a candidate for an IRM because groundwater monitoring data indicate the site appears to be impacting groundwater. Concentrations of ^{90}Sr and ^{99}Tc in downgradient well 199-B3-1 are larger than in upgradient wells 199-B5-2 and 199-B4-8 as shown in Figures 3-4 and 3-5. Groundwater from well 199-B3-1 contained 44 and 50 pCi/ℓ of ^{90}Sr, and 92 and 90 pCi/ℓ of ^{99}Tc for the July 1992 and October 1992 sampling rounds. Groundwater from well 199-B5-2 contained 15 and 19 pCi/ℓ of ^{90}Sr and 76 and 62 pCi/ℓ of ^{99}Tc for the July 1992 and October 1992 sampling rounds. Groundwater from well 199-B4-8 contained 1.3 and 1.3 pCi/ℓ of ^{90}Sr and 79 and 75 pCi/ℓ of ^{99}Tc for the July 1992 and October 1992 sampling rounds. Because high-priority sites 116-B-11, 116-B-13, 116-B-14, and 116-C-5 are also upgradient of well 199-B3-1 they may also be contributing to the contamination found in monitoring well 199-B3-1. The human health risks at site 116-B-1 are low and the EHQ is <1. The maximum concentration of Mn in the soil, 839 mg/kg, exceeds MTCA Method B guideline of 400 mg/kg. Natural attenuation by year 2018, e.g., radioactive decay, will reduce the risk posed by the principal contaminants and associated exposure pathway.

5.3.2 116-B-2 Trench and 116-B-3 Crib

The 116-B-2 trench and 116-B-3 crib are not recommended to continue as candidates for IRMs because the human health risks are low, EHQ ratings are <1, soil contamination does not exceed MTCA Method B guidelines, there is no current groundwater impact, and natural attenuation by 2018 will reduce the principal risk. The absence of impact to groundwater is indicated by comparing data from downgradient well 199-B4-9 and upgradient well 199-B4-4, shown in Figures 3-4, 3-5, and 3-6. Concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H from the upgradient and downgradient wells are essentially the same. Natural attenuation by year 2018, i.e., radioactive decay, will reduce the risk posed by the principal contaminants and associated exposure pathway.

5.3.3 116-B-5 Crib

The 116-B-5 crib is recommended to continue as a candidate for an IRM since the EHQ rating is >1. The human health risk is low, soil contamination does not exceed MTCA Method B guidelines and there is no current impact to groundwater. The absence of impact to groundwater is shown by comparing data from downgradient well 199-B4-1 and upgradient well 199-B4-9 shown in Figure 3-4, 3-5, and 3-6. Concentrations of ^{99}Tc and ^{3}H from the upgradient and downgradient wells are essentially the same. Concentrations of ^{90}Sr in the downgradient well are 12% to 25% lower than in the upgradient well. Natural attenuation by year 2018, i.e., radioactive decay, will reduce the risk posed by the principal contaminants and associated exposure pathway.

5.3.4 116-C-5 Retention Basin

The 116-C-5 retention basins are recommended to continue as candidates for IRMs because the human health risks are medium, EHQ ratings are >1, concentrations of metals present exceed MTCA Method B guidelines, and groundwater monitoring data indicate impact to groundwater. Concentrations of ^{90}Sr and ^{3}H in downgradient well 199-B3-47 are larger than in upgradient well 199-B5-2 as shown in Figures 3-4 and 3-6. Groundwater from well 199-B3-47 contained 21 and 20 pCi/ℓ of ^{90}Sr and 24,000 and 22,000 pCi/ℓ of ^{3}H for the July 1992 and October 1992 sampling rounds. Groundwater from well 199-B5-2 contained 15 and 19 pCi/ℓ of ^{90}Sr and 4800 and 3300 pCi/ℓ of ^{3}H for the July 1992 and October 1992 sampling rounds. The maximum concentration of Cr (609 mg/kg) and Mn (520 mg/kg) in the sludge exceeds the MTCA Method B guidelines of 400 mg/kg for hexavalent Cr and Mn. The maximum concentration of Mn (446 mg/kg) in soil exceeds the MTCA Method B guideline of 400 mg/kg for Mn. Natural attenuation by year 2018, i.e., radioactive decay, will not mitigate the risk posed by the principal contaminants and associated exposure pathway.

5.3.5 116-C-1 Liquid Waste Trench

The 116-C-1 liquid waste trench is recommended to continue as a candidate for an IRM because groundwater monitoring data indicate the site is impacting groundwater and human health risks are medium. Concentrations of ^{90}Sr and ^{99}Tc in downgradient well ~~199-B3-46 are larger than in upgradient wells 199-B5-2 and 199-B4-8 as shown in Figures~~ 3-4 and 3-5. Groundwater from well 199-B3-1 contained 57 and 130 pCi/ℓ of ^{90}Sr and 93 and 97 pCi/ℓ of ^{99}Tc for the July 1992 and October 1992 sampling rounds. Groundwater from well 199-B5-2 contained 15 and 19 pCi/ℓ of ^{90}Sr and 76 and 62 pCi/ℓ of ^{99}Tc for the July 1992 and October 1992 sampling rounds. Groundwater from well 199-B4-8 contained 1.3 and 1.3 pCi/ℓ of ^{90}Sr and 79 and 75 pCi/ℓ of ^{99}Tc for the July 1992 and October 1992 sampling rounds. The human health risk at site 116-C-1 are medium. The EHQ is <1. Concentrations of Mn are assumed to exceed MTCA Method B guidelines, because soil contamination is assumed to be similar to that found in the 116-B-1 LFI borehole samples. Natural attenuation by year 2018, i.e., radioactive decay, will reduce the risk posed by the principal contaminants and associated exposure pathway.

5.3.6 116-B-11 Retention Basin

The 116-B-11 retention basin is recommended to continue as a candidate for IRMs because the human health risks are high, EHQ ratings are > 1, concentrations of metals present may exceed MTCA Method B guidelines, and groundwater monitoring data indicate impact to groundwater. Evidence of impact to groundwater is provided by comparing data from downgradient well 199-B3-47 and upgradient well 199-B5-2. Concentrations of ^{90}Sr and ^{3}H in downgradient well 199-B3-47 are larger than in upgradient well 199-B5-2 as shown in Figures 3-4 and 3-6, and discussed above in Section 5.3.4. Contamination by metals in sludge and soil at 116-B-11 are assumed to be similar to the contamination at the 116-C-5 site, and thus are expected to exceed MTCA Method B guidelines for hexavalent Cr and Mn, i.e., 400 mg/kg. Natural attenuation by year 2018, i.e., radioactive decay, will not mitigate the risk posed by the principal contaminants and associated exposure pathway.

5.3.7 116-B-7, 132-B-6, and 132-C-2 Outfall Structures

The 116-B-7, 132-B-6, and 132-C-2 outfall structures are recommended to continue as IRM candidates because the human health risk is medium. One of the outfall structures, 132-B-6, is posted for surface contamination. No contaminants were found in the investigation of the analogous 116-D-5 site that exceed MTCA Method B guidelines. **The impact to groundwater monitoring wells are not available for confirmation. Natural attenuation by year 2018, i.e., radioactive decay, may not mitigate risk posed by the principal contaminants and associated exposure pathway.

5.3.8 Process Pipeline - Sludge and Soil

The process pipelines are recommended to continue as IRM candidates because they are a probable source of groundwater impact. Human health risks range from high (risk from sludge) to low (risk from contaminated soil). Environmental hazard quotient ratings also either exceed 1 (risk from sludge) or are < 1 (risk from contaminated soil). Concentrations of metals in pipeline sludge are assumed to be similar to 116-C-5 sludge and thus are expected to exceed MTCA Method B guidelines for Cr and Mn, i.e., 400 mg/kg. Contamination by Mn in soil is also expected to exceed MTCA Method B. Natural attenuation by year 2018, i.e., radioactive decay, will not mitigate the risk posed by the principal contaminants and associated exposure pathway.

5.3.9 116-B-13 and 116-B-14 Retention Basin Sludge Trenches

The 116-B-13 and 116-B-14 retention basin sludge trenches are recommended to continue as IRM candidates because the human health risks are medium, EHQ ratings are > 1, concentrations of metals are expected to exceed MTCA Method B guidelines, and there appears to be impact to groundwater at present. Evidence of impact to groundwater is provided by comparing data from downgradient well 199-B3-47 and upgradient well 199-B5-2. Concentrations of ^{90}Sr and ^{3}H in downgradient well 199-B3-47 are larger than in upgradient well 199-B5-2 as shown in Figures 3-4 and 3-6, and discussed above in Section 5.3.4. Contamination by metals in sludge and soil at 116-B-14 are assumed to be similar to the contamination at the 116-C-5 site, and thus are expected to exceed MTCA Method B guidelines for Cr and Mn, i.e., 400 mg/kg. Natural attenuation by year 2018, i.e., radioactive decay, will not mitigate the risk posed by the principal contaminants and associated exposure pathway.

5.3.10 116-B-6A Crib

The 116-B-6A crib is not recommended to continue as an IRM candidate since human health risks are low, soil contaminants are not expected to exceed MTCA Method B guidelines, and the site is not impacting groundwater. Evidence of non-impact to groundwater is provided by comparing data from downgradient well 199-B4-4 and upgradient well 199-B4-5. Concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H these two wells are not significantly different, as shown in Figures 3-4, 3-5, and 3-6. The 116-B-6A site is part of the in situ vitrification treatability test project during which the crib and surrounding soil were converted to a glassy matrix. Contaminants found in the surrounding soil prior to the test did not exceed MTCA Method B guidelines.

5.3.11 116-B-6B Crib

The 116-B-6B crib is not recommended to continue as an IRM candidate since human health risks are very low, the EHQ rating is < 1, soil contaminants are not expected to exceed MTCA Method B guidelines, and the site is not impacting groundwater. Evidence of non-impact to groundwater is provided by comparing data from downgradient well 199-B4-7 and upgradient well 199-B4-5. Concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H these two wells are not significantly different, as shown in Figures 3-4, 3-5, and 3-6. Natural attenuation by year 2018, i.e., radioactive decay, will not significantly affect the very low risk posed by the principal contaminants and associated exposure pathway.

5.3.12 116-B-4 Dummy Decontamination French Drain

The 116-B-4 dummy decontamination french drain is recommended to continue as an IRM candidate because the human health risk is medium. Soils at the site are not expected to contain contamination that would exceed MTCA Method B guidelines. Data to assess groundwater impact is provided by groundwater analyses for July and October 1992 sampling rounds from downgradient well 199-B4-9 and upgradient well 199-B4-4, as shown in Figures 3-4 and 3-5. The concentrations of ^{90}Sr, ^{99}Tc, and ^{3}H were not appreciably different in the two wells. The site is not currently impacting groundwater. Natural attenuation by year 2018, i.e., radioactive decay, will mitigate risk posed by the principal contaminants and associated exposure pathway.

5.3.13 116-B-9 French Drain and 116-B-10 Dry Well

The 116-B-9 french drain and 116-B-10 dry well are recommended to continue as IRM candidates. Because of uncertainty regarding the contaminants and concentrations of contaminants that the french drain and dry well received, the conceptual models are incomplete. Limited field sampling is recommended to resolve the uncertainties. Once the data are available these sites should be evaluated for continued consideration as IRM candidates.

5.3.14 116-B-12 Confinement Seal Drainage Crib

The 116-B-12 confinement seal drainage crib is recommended to continue as an IRM candidate because the human health risk is medium and there is current impact to groundwater. Data to assess groundwater impact is provided by groundwater analyses for July and October 1992 sampling rounds from downgradient well 199-B4-4 and upgradient well 199-B4-7, as shown in Figures 3-4 and 3-5. The ^{90}Sr concentrations in groundwater from well 199-B4-4 are 26 and 33 pCi/ℓ for samples collected in July and October of 1992. These concentrations are 3 to 6 times larger than values for 199-B4-7, 8.1 and 5.2 pCi/ℓ. The concentrations of ^{99}Tc and ^{3}H are not appreciably different between the two wells. Soil contaminant concentrations are not expected to exceed MTCA Method B guidelines, based on data from analogous site 116-D-9. Natural attenuation by year 2018, i.e., radioactive decay, may not mitigate risk posed by the principal contaminants and associated exposure pathway.

5.3.15 132-B-4 and 132-B-5 Decommissioned Filter Building and Gas Recirculation Building

The 132-B-4 and 132-B-5 decommissioned filter building and decommissioned gas recirculation building and tunnels are recommended to continue as IRM candidates because the EHQ rating is > 1 and the sites may be impacting groundwater. Impact to groundwater may be probable since the sites are upgradient of well 199-B4-4 and downgradient of well 199-B4-7. The sites may be contributing to the elevated ^{90}Sr described in Section 5.3.14 above, for site 116-B-12. The human health risk is very low. Concentrations of non-radionuclide contaminants in soil at the sites are not expected to exceed MTCA Method B guidelines. Natural attenuation by year 2018, i.e., radioactive decay, may not mitigate risk posed by the principal contaminants and associated exposure pathway.

5.3.16 126-B-2 Clearwells and 128-B-3 Burn Pit

The 126-B-2 clearwells and 128-B-3 burn pit are not recommended to continue as IRM candidates because the human health risks are low, they are probably not impacting groundwater, and concentrations of contaminants at the sites are not expected to exceed MTCA Method B guidelines. Data from monitoring well 199-B5-1 indicates that the 126-B-2 clearwells are not impacting groundwater as shown in Figures 3-4, 3-5, and 3-6.

Groundwater monitoring wells and data are not available to determine whether the 128-B-3 burn pit is currently impacting groundwater. The potential for natural attenuation of the radionuclides is not a consideration as no radionuclides are thought to be present.

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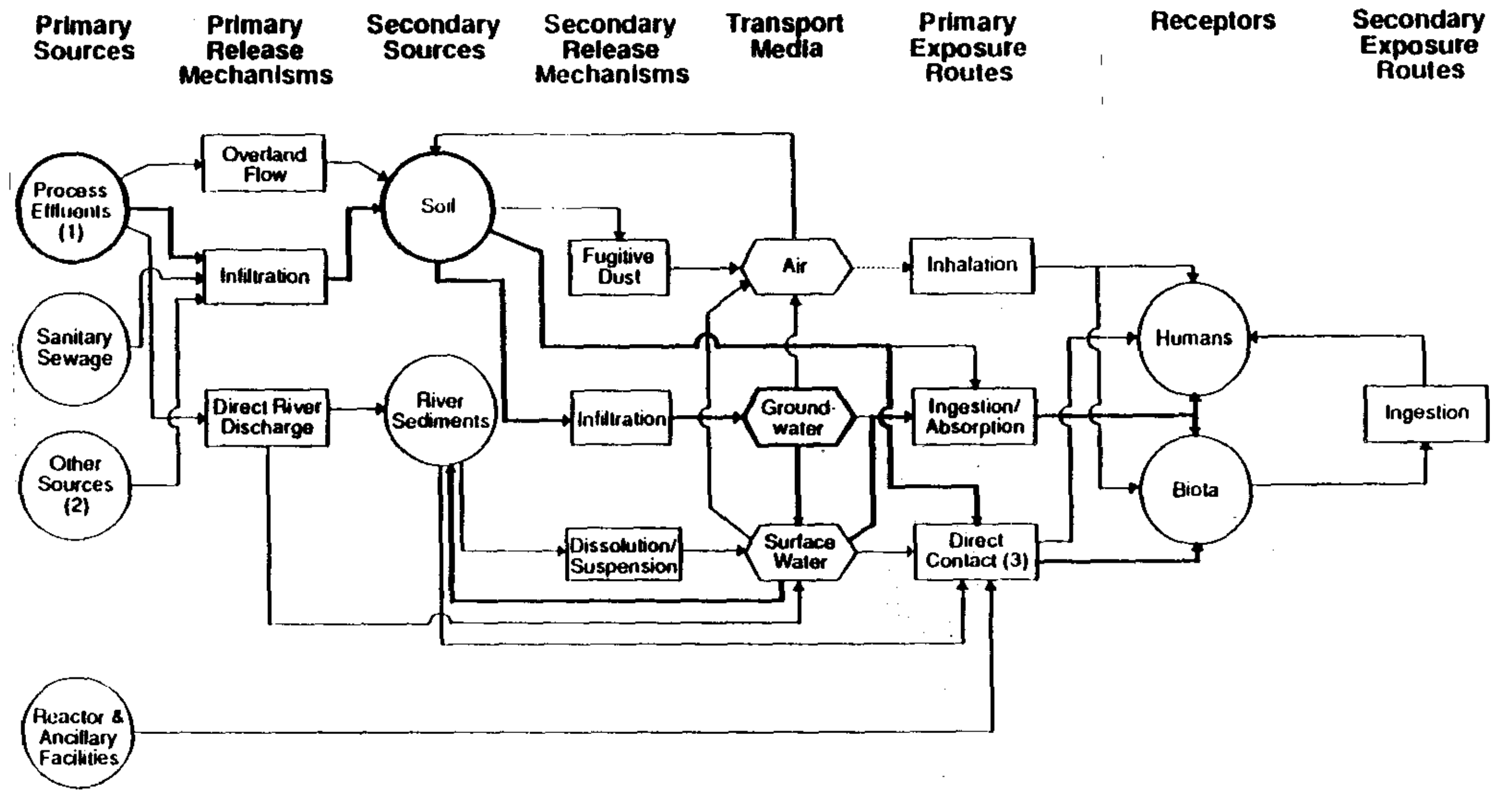
Figure 5-1 Conceptual Model Contaminant Exposure Pathway for the 100-BC-1 Operable Unit



(1) Includes all facilities that received process effluents, including pipelines, basins, cribs, trenches, french drains, and outfall structures.

(2) Includes other sources within limited existing information

(3) Includes exposure to radiation.

LEGEND

→ Potential Exposure Pathway

→ Potential Primary Exposure Pathway

○ ⬭ Primary contaminant sources and known contaminated media

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Table 5-1 Conceptual Model of 100-BC-1 High-Priority Sites: Structure/Process, Source and Type of Contaminants, and Nature and Extent of Contamination (page 1 of 3)

Site	Structure/Process	Contaminant Source	Contaminants	Nature and Extent of Contamination[a]
116-B-1	Effluent disposal trench, unlined - 61m x 9m x 5m deep	Received 60 million ℓ of high activity effluent produced by failed fuel elements, disposed effluent to soil	^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, U, Pu, ^{241}Am, Cr, Mn, Zn	Soil contamination from 1.5m to at least 7m below grade, maximum contamination from 5m to 6m, source of groundwater contamination
116-C-1	Effluent disposal trench, unlined - 152m x 15m x 8m deep	Received 700 million ℓ of high activity effluent produced by failed fuel elements, disposed effluent to soil	^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, U, Pu, ^{241}Am, Cr, Mn, Zn	Soil contamination from 1.5m to at least 11m below grade, maximum contamination observed between 5m to 7m, source of groundwater contamination
116-B-11	Retention basin, reinforced concrete, single containment - 142m x 70m x 6m deep	Held cooling water effluent from B reactor for cooling/decay before release to the Columbia River, large leaks of effluent to soil	^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{226}Ra, U, Pu, also probable contamination with Cr, Cu, Fe, Hg, Mn, Pb, Zn	Soil contamination to at least 6m below grade with most in 2.4m to 4m interval, also contaminated sludge, fill, concrete, and groundwater. Surface soil contamination present outside basin also.
116-C-5	Retention basins (two), steel sides and floor, open top, single containment - 101m diameter x 5m deep	Held cooling water effluent from B and C reactors for cooling/decay before release to the Columbia River, large leaks of effluent to soil	^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, U, Pu, Cr, Cu, Fe, Hg, Mn, Pb, Zn, semi-volatiles[b]	Soil contamination to at least 6m below grade, most contamination between 0m and 2.4m below grade, contaminated sludge, fill, concrete (foundations), and groundwater. Surface soil contamination present outside basins also.
116-B-2	Fuel basin storage trench, unlined - 23m x 3m x 5m deep	Received 4 million ℓ of high activity water drained from B reactor fuel storage basin after water contaminated when fuel element cut in half, disposed effluent to soil	^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, U, Pu, ^{241}Am, Cd, Cr, Hg, Ni, semi-volatiles[c]	Soil contaminated to at least 7.6m with most in the 3m to 5m interval, possible groundwater contamination
116-B-3	Pluto crib, unlined - 3m x 3m x 3m deep	Received 4000 ℓ of high activity effluent from B reactor process tubes contaminated by fuel element failures, disposed effluent to soil	^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, U, Pu, ^{241}Am, Ag, Cr, semi-volatiles[d]	Soil contaminated from 2m to 5m with most 2.2m to 2.8m interval, possible groundwater contamination
116-B-5	Crib, unlined - 26m x 5m x 3m deep	Received 10 million ℓ of low-level effluent from contaminated maintenance shop and decontamination pad in 108-B building including liquid tritium waste, disposed effluent to soil	^{3}H, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{241}Am, Ba, Hg, Zn	Soil by radionuclides found in 2m to 5m interval.

Table 5-1 Conceptual Model of 100-BC-1 High-Priority Sites: Structure/Process, Source and Type of Contaminants, and Nature and Extent of Contamination (page 2 of 3)

Site	Structure/Process	Contaminant Source	Contaminants	Nature and Extent of Contamination*
116-B-7, 132-B-6, and 132-C-2	Outfall structures are reinforced concrete sumps connected to discharge pipelines and spillways; sumps located on bank above high water line; spillways extended from sumps into river - 116-B-7 and 132-B-6 sumps are 8.2m x 4.2m x 6.4m deep, 132-C-2 sump is 8.2m x 16m x 6.4m deep. 132-B-6 and 132-C-2 partly demolished	Discharged cooling water effluent and process sewer effluent through sump to effluent discharge pipeline outlet at bottom center of Columbia River or from sump to spillway that discharged on shoreline	^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, U, Pu, Cr	Surface contamination at 132-B-6 spillway soil contamination beneath sumps, pipelines, and spillways
Process Effluent Pipelines	Total length about 2100m, pipe diameter 76cm, 122cm, and 167cm, buried 6m bls	Transported reactor cooling water from reactors to retention basins, outfall structures, 116-B-1 and 116-C-1 trenches, leaked effluent to soil, contains contaminated sludge and scale	^{3}H, ^{14}C, ^{14}C, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{226}Ra, U, Pu, ^{241}Am, Cr, Cu, Fe, Hg, Pb, Zn	Surface soil contamination near retention basins, contamination extends to at least 11m below grade, maximum contamination reported at ~7m
116-B-13	South sludge trench, unlined - 15m x 15m x 3m deep	Received sludge from 116-B-11 retention basin, sludge disposed to soil then trench backfilled	^{3}H, ^{14}C, ^{14}C, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{226}Ra, U, Pu, ^{241}Am, Cr, Cu, Fe, Hg, Mn, Pb, Zn	Soil contamination from 0m to 7m, most in 0m to 3m interval, possible source of groundwater contamination.
116-B-14	North sludge trench, unlined - 37m x 3m x 3m deep	Received sludge from 116-B-11 retention basin, sludge disposed to soil then trench backfilled	^{3}H, ^{14}C, ^{14}C, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{226}Ra, U, Pu, ^{241}Am, Cr, Cu, Fe, Hg, Mn, Pb, Zn	Soil contamination from 0m to 7m below grade, most in 0m to 3m interval, possible source of groundwater contamination.
116-B-6B	Crib, unlined, excavation filled with gravel, 2m of soil cover- 4m x 2.4m x 2m deep	Received radioactive liquid waste from equipment decontamination at 111-B building decontamination station, disposed effluent to soil	^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{155}Eu, U	Soil contamination from surface to 8.5m below grade with most in the 2m to 5m interval
116-B-4	French drain, gravel-filled - 1.2m x 6m deep	Received 300,000 ℓ of effluent, e.g., contaminated spent acid from dummy decontamination facility, disposed effluent to soil	^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{226}Ra, ^{228}Th, Pu, U, Cr, nitrate, sodium oxalate, sodium sulfamate	Soil contamination from 0.3m to 5.5m below grade, with most in the 3.7m to 5.5m interval below grade.
116-B-9	French drain - 1.2m x 0.9m deep	Received 40,000 ℓ of effluent from P-10 storage building drain, disposed effluent to soil	Assumed to be ^{3}H, Hg	Nature and vertical extent of contamination not known, sampling and analysis needed to supply data.
116-B-10	Dry well - 0.9m x 2m deep	Received 5 million ℓ of liquid decontamination wastes from 108-B facility, disposed effluent to soil	Assumed to be ^{3}H, Cr, nitrate	Nature and vertical extent of contamination not known, sampling and analysis needed to supply data.

Table 5-1 Conceptual Model of 100-BC-1 High-Priority Sites: Structure/Process, Source and Type of Contaminants, and Nature and Extent of Contamination (page 3 of 3)

Site	Structure/Process	Contaminant Source	Contaminants	Nature and Extent of Contamination[a]
116-B-12	Confinement seal crib - 3m x 3m x 3m deep	Received drainage from confinement seal system in 117-B building seal pits, disposed effluent to soil	^{3}H, ^{14}C, ^{90}Sr, ^{241}Am	Soil contamination to 8m, maximum found 6m below grade and source of groundwater contamination.
118-B-5	Ball 3X burial ground - 15m x 3m x 3m deep	Highly contaminated reactor components removed from B reactor	^{60}Co and ^{63}Ni	Soil contaminants likely in the interval 1m to 3m below grade
118-B-7	Burial ground - 2m x 2m x 2m deep	Miscellaneous solid waste, e.g., decontamination materials and associated equipment	^{60}Co and ^{63}Ni	Soil contaminants likely in the 0m to 2m interval below grade
132-B-4	Demolished reinforced concrete building and tunnels, building - 18m x 12m x 11m high, tunnels - 58m long	Contaminated building demolished in place, buried, covered with fill	^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{238}Pu, and $^{239/240}$Pu	Contaminated concrete and rubble buried in place in the interval 1m to 5m below grade, covered by clean fill
132-B-5	Demolished reinforced concrete building - 51m x 22m to 30m x 9.5m tall	Contaminated gas recirculation building demolished in place, buried, covered with fill	^{3}H, ^{14}C, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{238}Pu, and $^{239/240}$Pu	Contaminated concrete and rubble filling basement 3.3m below grade, covered by clean fill
116-B-6A	Crib, constructed of wooden timbers and rocky fill - 3.7m x 2.4m x 4.6m deep	Received 5,000 ℓ of radioactive effluent from 111-B equipment decontamination station, soil converted to glassy material in vitrification treatability test in May 1990	^{60}Co, ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, U, $^{239/240}$Pu, Cd, Cu, Pb, Zn	Prior to vitrification, contaminated soil existed to 8.5m below grade, with most in the 2m to 5m interval. Contaminants may be immobilized in the glassy material.
128-B-3	Burn pit and demolition waste site - 30m x 30m x 3m	Paint waste, chemical solvents, and office waste disposed by burning, and demolition waste	No known contamination	No known contamination
126-B-2	Clear wells - 229m long x 41m wide	Demolition waste from above ground portion of the pump room	Demolition waste, nonhazardous	No known contamination

[a] Lateral extent of contamination is assumed to be equal to the facility dimensions, unless otherwise noted. The limited field investigation was not designed to establish the lateral (areal) extent of contamination

[b] Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, pentachlorophenol

[c] N-nitrosodiphenylamine, pyrene

[d] Anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, fluoranthene, phenanthrene

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Table 5-2 Hanford Site Background 95% Upper Threshold Limits (UTLs) and Model Toxics Control Act (MTCA) Method B Guidelines for Inorganic Analytes.

Analyte[a]	95% UTL[b] (mg/kg)	MTCA Method B[c] (mg/kg)
Alkalinity	23,300	N/L
Ammonia	28.2	N/L
Antimony	15.7[d]	32
Arsenic	8.92	24 (0.59)[e]
Barium	171	5,600
Beryllium	1.77	400 (0.23)[e]
Cadmium	0.66[d]	40
Chloride	763	N/L
Chromium	27.9	400[f]
Cobalt	19.6	N/L
Copper	28.2	3,200
Fluoride	12	4,800
Lead	14.75	U
Lithium	37.1	N/L
Manganese	612	400
Mercury	1.25	24
Molybdenum	1.4[d]	400
Nickel	25.3	1,600
Nitrate	199	130,000
Nitrite	21[d]	8,000
Ortho-phosphate	16	N/L
Selenium	5[d]	400
Silicon	192	N/L
Silver	2.7	400
Sulfate	1,320	N/L
Thallium	3.7[d]	5.6 - 7.2[g]
Titanium	3,570	N/L
Vanadium	111	560
Zinc	79	24,000
Zirconium	57.3	N/L

Source: DOE-RL 1993c
NL = Not listed in MTCA Human Health Risk Based Method B Formula Values table for soil
U = Unavailable
[a] Analytes essentially non-toxic in soil are not listed (DOE-RL 1993a). These include aluminum, calcium, iron, magnesium, potassium, sodium.
[b] 95% confidence limit of the 95th percentile of the data distribution
[c] Non-carcinogen risk-based concentration, no carcinogen risk except as shown in parenthesis
[d] Limit of detection
[e] Carcinogen risk-based concentration in parenthesis
[f] Hexavalent chromium
[g] Range of risk-based concentrations for thallium compounds

Table 5-3 IRM Recommendations for 100-BC-1 High-Priority Sites

Waste Site	Qualitative Risk Assessment		Conceptual Model	Exceeds ARAR	Probable Current Impact on Groundwater	Potential for Natural Attenuation by 2018	IRM Candidate yes/no
	Low-frequency scenario	EHQ > 1					
116-B-1	low	no	adequate	yes	yes	yes	yes
116-B-2	low	no	adequate	no	no	yes	no
116-B-3	low	no	adequate	no	no	yes	no
116-B-5	low	yes	adequate	no	no	yes	yes
116-C-5	medium	yes	adequate	yes	yes	no	yes
116-C-1	medium	no	adequate	yes	yes	yes	yes
116-B-11	high	yes	adequate	yes	yes	no	yes
116-B-7, 132-B-6, and 132-C-2	medium	-	adequate	no	no	no	yes
Process Pipe (sludge)	high	yes	adequate	yes	yes	no	yes
Process Pipe (soil)	low	no	adequate	yes	yes	no	yes
116-B-13/14	medium	yes	adequate	yes	yes	no	yes
116-B-6A	low	-	adequate	no	no	no	no
116-B-6B	very low	no	adequate	no	no	no	no
116-B-4	medium	-	adequate	no	no	yes	yes
116-B-9	low	-	incomplete*	unknown*	no	unknown*	yes*
116-B-10	high	-	incomplete*	unknown*	no	unknown*	yes*
116-B-12	medium	-	adequate	no	yes	no	yes
132-B-4 and 132-B-5	very low	yes	adequate	no	yes	no	yes
128-B-3	low	-	adequate	no	no	no	no
126-B-2	low	-	adequate	no	no	no	no
118-B-5, 118-B-7, and 118-B-10 Burial grounds							yes

EHQ = environmental hazard quotient calculated by the qualitative ecological risk assessment
- = Not rated by the qualitative ecological risk assessment
* = Data needed concerning nature and vertical extent of contamination, site remains an IRM candidate until data are available.
ARAR = applicable or relevant and appropriate requirements, specifically the Washington state Model Toxics Control Act Method B concentration values for soils
IRM = interim remedial action

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APPENDIX A

DATA SETS FOR NON-WASTE SITE SOIL SAMPLES AND QUALITATIVE RISK ASSESSMENT

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100-BC-1 Operable Unit Non-Waste Site Soil Samples - Volatile Organic Compounds (concentrations in $\mu g/kg$) from *Data Validation Report for the 100-BC-1 Operable Unit Vadose Boreholes* (WHC 1992a)

Project: Westinghouse							
Laboratory: TMA							
Case 04050	SDG: B05XZ4						
Sample Number		B05XZ4		B05XZ5			
Location							
Remarks							
Sample Date		4/14/92		4/14/92			
Analysis Date		4/21/92		4/21/92			
Volatile Organic Compound	CRQL	Result	Q	Result	Q	Result	Q
Chloromethane	10	11	U	11	U		
Bromomethane	10	11	U	11	U		
Vinyl Chloride	10	11	U	11	U		
Chloroethane	10	11	U	11	U		
Methylene Chloride	10	3	J	4	J		
Acetone	10	15	U	11	U		
Carbon Disulfide	10	11	U	11	U		
1,1-Dichloroethene	10	11	U	11	U		
1,1-Dichloroethane	10	11	U	11	U		
1,2-Dichloroethene (total)	10	11	U	11	U		
Chloroform	10	11	U	2	J		
1,2-Dichloroethane	10	11	U	11	U		
2-Butanone	10	11	U	11	U		
1,1,1-Trichloroethane	10	11	U	11	U		
Carbon Tetrachloride	10	11	U	11	U		
Bromodichloromethane	10	11	U	11	U		
1,2-Dichloropropane	10	11	U	11	U		
cis-1,3-Dichloropropene	10	11	U	11	U		
Trichloroethene	10	11	U	11	U		
Dibromochloromethane	10	11	U	11	U		
1,1,2-Trichloroethane	10	11	U	11	U		
Benzene	10	11	U	11	U		
trans-1,3-Dichloropropene	10	11	U	11	U		
Bromoform	10	11	U	11	U		
4-Methyl-2-pentanone	10	11	U	11	U		
2-Hexanone	10	11	U	11	U		
Tetrachloroethene	10	11	U	11	U		
1,1,2,2-Tetrachloroethane	10	11	U	11	U		
Toluene	10	4	J	6	J		
Chlorobenzene	10	11	U	11	U		
Ethylbenzene	10	11	U	11	U		
Styrene	10	11	U	11	U		
Xylene (total)	10	11	U	11	U		

100-BC-1 Operable Unit Non-Waste Site Soil Samples - Semi-Volatile Organic Compounds (concentrations in $\mu g/kg$) from *Data Validation Report for the 100-BC-1 Operable Unit Vadose Boreholes* (WHC 1992a)

Project: Westinghouse							
Laboratory: TMA							
Case: 04050	SDG: B05XZ4						
Sample Number		B05XZ4		B05XZ5			
Location							
Remarks							
Sample Date		04/14/92		04/14/92			
Extraction Date		4/20/92		4/20/92			
Analysis Date		5/5/92		5/5/92			
Semivolatile Compound	CRQL	Result	Q	Result	Q	Result	Q
Phenol	330	350	U	370	U		
bis(2-Chloroethyl)ether	330	350	U	370	U		
2-Chlorophenol	330	350	U	370	U		
1,3-Dichlorobenzene	330	350	U	370	U		
1,4-Dichlorobenzene	330	350	U	370	U		
1,2-Dichlorobenzene	330	350	U	370	U		
2-Methylphenol	330	350	U	370	U		
2,2'-oxybis(1-Chloropropane)	330	350	U	370	U		
4-Methylphenol	330	350	U	370	U		
N-Nitroso-di-n-propylamine	330	350	U	370	U		
Hexachloroethane	330	350	U	370	U		
Nitrobenzene	330	350	U	370	U		
Isophorone	330	350	U	370	U		
2-Nitrophenol	330	350	U	370	U		
2,4-Dimethylphenol	330	350	U	370	U		
Benzoic acid	1700						
bis(2-Chloroethoxy)methane	330	350	U	370	U		
2,4-Dichlorophenol	330	350	U	370	U		
1,2,4-Trichlorobenzene	330	350	U	370	U		
Naphthalene	330	350	U	370	U		
4-Chloroaniline	330	350	U	370	U		
Hexachlorobutadiene	330	350	U	370	U		
4-Chloro-3-methylphenol	330	350	U	370	U		
2-Methylnaphthalene	330	350	U	370	U		
Hexachlorocyclopentadiene	330	350	U	370	U		
2,4,6-Trichlorophenol	330	350	U	370	U		
2,4,5-Trichlorophenol	1700	840	U	890	U		
2-Chloronaphthalene	330	350	U	370	U		
2-Nitroaniline	1700	840	U	890	U		
Dimethylphthalate	330	350	U	370	U		
Acenaphthylene	330	350	U	370	U		
2,6-Dinitrotoluene	330						
3-Nitroaniline	1700	840	U	890	U		

100-BC-1 Operable Unit Non-Waste Site Soil Samples - Semi-Volatile Organic Compounds (concentrations in $\mu g/kg$) from *Data Validation Report for the 100-BC-1 Operable Unit Vadose Boreholes* (WHC 1992a)

Project: Westinghouse							
Laboratory: TMA							
Case: 04050	SDG: B05XZ4						
Sample Number		B05XZ4		B05XZ5			
Location							
Remarks							
Sample Date		04/14/92		04/14/92			
Extraction Date		4/20/92		4/20/92			
Analysis Date		5/5/92		5/5/92			
Semivolatile Compound	CRQL	Result	Q	Result	Q	Result	Q
Acenaphthene	330	350	U	370	U		
2,4-Dinitrophenol	1700	840	U	890	U		
4-Nitrophenol	1700	840	U	890	U		
Dibenzofuran	330	350	U	370	U		
2,4-Dinitrotoluene	330	350	U	370	U		
Diethylphthalate	330	350	U	370	U		
4-Chlorophenyl-phenyl ether	330	350	U	370	U		
Fluorene	330	350	U	370	U		
4-Nitroaniline	1700	840	U	890	U		
4,6-Dinitro-2-methylphenol	1700	840	U	890	U		
N-Nitrosodiphenylamine	330	350	U	370	U		
4-Bromophenyl-phenylether	330	350	U	370	U		
Hexachlorobenzene	330	350	U	370	U		
Pentachlorophenol	1700	840	U	890	U		
Phenanthrene	330	350	U	370	U		
Anthracene	330	350	U	370	U		
Carbazole	330	350	U	370	U		
Di-n-butylphthalate	330	350	U	370	U		
Fluoranthene	330	350	U	370	U		
Pyrene	330	350	U	370	U		
Butylbenzylphthalate	330	350	U	370	U		
3,3'-Dichlorobenzidine	330	350	U	370	U		
Benz(a)anthracene	330	350	U	370	U		
Chrysene	330	350	U	370	U		
bis(2-Ethylhexyl)phthalate	330	350	U	370	U		
Di-n-octylphthalate	330	350	U	370	U		
Benzo(b)fluoranthene	330	350	U	370	U		
Benzo(k)fluoranthene	330	350	U	370	U		
Benzo(a)pyrene	330	350	U	370	U		
Indeno(1,2,3-cd)pyrene	330	350	U	370	U		
Dibenz(a,h)anthracene	330	350	U	370	U		
Benzo(g,h,i)perylene	330	350	U	370	U		

100-BC-1 Operable Unit Non-Waste Site Soil Samples - Pesticide/PCB Compounds (concentrations in $\mu g/kg$) from *Data Validation Report for the 100-BC-1 Operable Unit Vadose Boreholes* (WHC 1992a)

Project: Westinghouse							
Laboratory: TMA							
Case: 04050	SDG: B05XZ4						
Sample Number		B05XZ4		B05XZ5			
Location							
Remarks							
Sample Date		04/14/92		04/14/92			
Extraction Date		4/20/92		4/20/92			
Analysis Date		5/25/92		5/25/92			
Pesticide/PCB	CRQL	Result	Q	Result	Q	Result	Q
alpha-BHC	1.7	1.8	U	1.9	U		
beta-BHC	1.7	1.80	U	1.9	U		
delta-BHC	1.7	1.80	U	1.9	U		
gamma-BHC (Lindane)	1.7	1.80	U	1.9	U		
Heptchlor	1.7	1.80	U	1.9	U		
Aldrin	1.7	1.80	U	1.9	U		
Heptachlor epoxide	1.7	1.80	U	1.9	U		
Endosulfan I	1.7	1.80	U	1.9	U		
Dieldrin	3.3	3.50	U	3.7	U		
4,4'-DDE	3.3	3.5	U	3.7	U		
Endrin	3.3	3.5	U	3.7	U		
Endosulfan II	3.3	3.5	U	3.7	U		
4,4'-DDD	3.3	3.5	U	3.7	U		
Endosulfan sulfate	3.3	3.5	U	3.7	U		
4,4'-DDT	3.3	3.5	U	3.7	U		
Methoxychlor	17.0	18.0	U	19	U		
Endrin Ketone	3.3	3.5	U	3.7	U		
Endrin Aldehyde	3.3						
alpha-Chlordane	1.7	1.8	U	1.9	U		
gamma-Chlordane	1.7	1.8	U	1.9	U		
Toxaphene	170.0	180.0	U	190	U		
Arochlor-1016	33.0	35.0	U	37	U		
Arochlor-1221	33.0	72.0	U	74	U		
Arochlor-1232	67.0	35.0	U	37	U		
Arochlor-1242	33.0	35.0	U	37	U		
Arochlor-1248	33.0	35.0	U	37	U		
Arochlor-1254	33.0	35.0	U	37	U		
Arochlor-1260	33.0	35.0	U	37	U		

100-BC-1 Operable Unit Non-Waste Site Soil Samples - Inrganic Compounds (concentrations in mg/kg) from *Data Validation Report for the 100-BC-1 Operable Unit Vadose Boreholes* (WHC 1992a)

9413207.1205

Project: Westinghouse							
Laboratory: TMA							
Case: N2-04-073	SDG: B05XZ4						
Sample Number		B05XZ4		B05XZ5			
Location							
Remarks							
Sample Date		4/14/92		4/14/92			
Inorganic Analytes	CRQL	Result	Q	Result	Q	Result	Q
Aluminum	200	6640.0		6860.0			
Antimony	60	3.30	UJ	3.20	UJ		
Arsenic	10	2.20		2.80			
Barium	200	71.00		77.20			
Beryllium	5	0.24		0.23			
Cadmium	5	0.46		0.40	U		
Calcium	5000	3300.0		3760.0			
Chromium	10	8.00		8.90			
Cobalt	50	8.20		7.60			
Copper	25	11.20		13.10			
Iron	100	14900		14300			
Lead	3	4.80		4.40			
Magnesium	5000	3610.0		3860.0			
Manganese	15	296.00		286.00			
Mercury	0.2	0.10	U	0.10	U		
Nickel	40	8.30		9.80			
Potassium	5000	1490.0		1570.0			
Selenium	5	4.20	UJ	4.20	UJ		
Silver	10	0.42	U	0.40	U		
Sodium	5000	129.00		130.00			
Thallium	10	0.42	U	2.10	U		
Vanadium	50	30.00		27.70			
Zinc	20	39.60		36.60			
Cyanide	10	0.51	U	0.53	U		

100-BC-1 Operable Unit Non-Waste Site Soil Samples - Wet Chemistry/Anions (concentrations in mg/kg) from *Data Validation Report for the 100-BC-1 Operable Unit Vadose Boreholes* (WHC 1992a)

Project: Westinghouse							
Laboratory: TMA							
Case: N2-04-073	SDG: B05XZ4						
Sample Number		B05XZ4		B05XZ5			
Location							
Remarks							
Sample Date		4/14/92		4/14/92			
Wet Chemistry Anal	CRQL	Result	Q	Result	Q	Result	Q
Fluoride	1.0	2.10		2.0			
N03N02	0.25	5.09		4.19			
Nitrate	2.0	5.90		5.60			
Sulfate	10.0	32.0		32.0			

100-BC-1 Operable Unit Non-Waste Site Soil Samples - Radiochemistry (concentrations in pCi/g ± 2 standard deviations) from *Data Validation Report for the 100-BC-1 Operable Unit Vadose Boreholes* (WHC 1992a)

Project: Westinghouse								
Laboratory: TMA								
Case:			SDG: B05XY8					
Sample Number	B05XZ4		B05XZ4		B05XZ5		B05XZ5	
Location								
Remarks	WHC 1992a		HEIS Data		WHC 1992a		HEIS Data	
Analysis Date	7/8/92		7/8/92		7/8/92		7/8/92	
Analytes	Results	Q	Result	Q	Result	Q	Result	Q
Gross Alpha	-8.35	~~R~~	-8.35	U	-7.6	~~R~~	-7.6	U
Gross Beta	10.6	R	10.6		7.82	R	7.82	
Uranium 233/234	~~5.89~~	J	0.589		0.621	J	0.621	
Uranium 235	~~2.55~~	~~U~~	0.0255		0.0202	R	0.0202	
Uranium 238	~~6.34~~	J	0.634		0.621	J	0.621	
Plutonium 238	0	~~J~~	0	U	0.0476	J	0.047	
Plutonium 239/240	~~0.431~~		0.00431		~~0.067~~		0.0067	
Americium 241	~~1.18~~		0.0118		0		0	U
Strontium 90	~~2.09~~	J	0.209		-0.341	~~J~~	-0.341	U
Carbon 14	2.49	~~UJ~~	2.49		2.48	~~UJ~~	2.48	
Potassium 40	~~1.356~~	J	13.56		13.85	J	13.85	
Chromium 51	~~<5.328~~	~~UJ~~	5.328	U	~~<5.888~~	~~UJ~~	5.888	U
Cobalt 60	~~<1.546~~	~~UJ~~	0.1546	U	~~<0.1832~~	~~UJ~~	0.1832	U
Zinc 65	~~<3.789~~	~~UJ~~	0.3789	U	~~<0.5532~~	~~UJ~~	0.5532	U
Cesium 134	~~<1.762~~	~~UJ~~	0.1762	U	~~<0.2081~~	~~UJ~~	0.2081	U
Cesium 137	~~<1.434~~	~~UJ~~	0.1434	U	~~<0.1621~~	~~UJ~~	0.1621	U
Radium 226	~~5.253~~	J	0.5253		0.8203	J	0.8203	
Thorium 228	~~6.502~~	J	0.6502		1.179	J	1.179	
Thorium 232	1.3	J	1.3		0.8674	J	0.8674	

100-BC-1 Qualitative Risk Assessment Data Set.

The reports contained herein are for informational purposes only. Minor parameter label differences are due to the manner in which the various laboratories and the validation reports refer to the parameters.

Concentrations are reported in the following units:

ug/kg - microgram per kilogram concentrations are used for organic constituents
mg/kg - milligram per kilogram concentrations are used inorganic constituents
pCi/g - picoCurie per gram concentrations are used for radionuclide constituents

Analytical results listed as "N/R" indicate that the constituent was not found, and thus not reported by the analytical laboratory. The "N/R" code occurs predominantly in radionuclide analytical data, although a few organic constituents are also listed as "N/R."

An individual analytical result may be accompanied by one of the following qualifier, i.e., "Q", codes:

B - Radionuclide or inorganic constituent detected in concentration less than the detection limit. For organic constituents the "B" code indicates that the constituent was found in the associated blank sample.

BJ - Radionuclide or inorganic constituent detected in concentration less than the detection limit, but concentration is an estimate due to quality control deficiencies.

J - Concentration value is an estimate due to quality control deficiencies.

U - Constituent not detected, concentration value shown is the detection limit.

R - Data rejected during validation for quality control deficiencies, principally for administrative reasons. Independent verification of radionuclide data indicates that "R" flagged radionuclide data are useable.

UJ - Constituent not detected, concentration shown is the estimated detection limit. Detection limit can only be estimated due to quality control deficiencies.

UR - Constituent not detected, concentration shown is the detection limit, and data flagged as rejected during validation.

Location 116-B-1

Parameter	Samp# Depth / Units	B05XY1 17.00 Result	Q	B05XY4 19.00 Result	Q	B05XY4RE 19.00 Result	Q	B05XY5 22.00 Result	Q	B05XY5RE 22.00 Result	Q	B05XY6 27.00 Result	Q
Volatiles													
CHLOROMETHANE	ug/Kg	11.000	U	11.000	U	N/R		11.000	U	N/R		10.000	U
BROMOMETHANE	ug/Kg	11.000	U	11.000	U	N/R		11.000	U	N/R		10.000	U
VINYL CHLORIDE	ug/Kg	11.000	U	11.000	U	N/R		11.000	U	N/R		10.000	U
CHLOROETHANE	ug/Kg	11.000	U	11.000	U	N/R		11.000	U	N/R		10.000	U
METHYLENE CHLORIDE	ug/Kg	5.000	UJ	3.000	UJ	N/R		3.000	UJ	N/R		3.000	UJ
ACETONE	ug/Kg	53.000	U	52.000	U	N/R		70.000	U	N/R		46.000	U
CARBON DISULFIDE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
1,1-DICHLOROETHENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
1,1-DICHLOROETHANE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
1,2-DICHLOROETHENE (TOTAL)	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
CHLOROFORM	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
1,2-DICHLOROETHANE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
2-BUTANONE	ug/Kg	11.000	U	11.000	U	N/R		11.000	U	N/R		10.000	U
1,1,1-TRICHLOROETHANE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
CARBON TETRACHLORIDE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
VINYL ACETATE	ug/Kg	11.000	U	11.000	U	N/R		11.000	U	N/R		10.000	U
BROMODICHLOROMETHANE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
1,2-DICHLOROPROPANE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
CIS-1,3-DICHLOROPROPENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
TRICHLOROETHENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
DIBROMOCHLOROMETHANE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
1,1,2-TRICHLOROETHANE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
BENZENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
TRANS-1,3-DICHLOROPROPENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
2-CHLOROETHOXY ETHENE		N/R		N/R		N/R		N/R		N/R		N/R	
BROMOFORM	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
4-METHYL-2-PENTANONE	ug/Kg	11.000	U	11.000	U	N/R		11.000	U	N/R		10.000	U
2-HEXANONE	ug/Kg	11.000	U	11.000	U	N/R		11.000	U	N/R		10.000	U
TETRACHLOROETHENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
1,1,2,2-TETRACHLOROETHANE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
TOLUENE	ug/Kg	10.000	U	2.000	UJ	N/R		3.000	UJ	N/R		1.000	UJ
CHLOROBENZENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
ETHYLBENZENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
STYRENE	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
XYLENES (TOTAL)	ug/Kg	5.000	U	5.000	U	N/R		5.000	U	N/R		5.000	U
Semi-volatiles													
PHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
ANILINE		N/R		N/R		N/R		N/R		N/R		N/R	

Location 116-B-1

Parameter	Samp# Depth / Units	B05XY1 17.00 Result	Q	B05XY4 19.00 Result	Q	B05XY4RE 19.00 Result	Q	B05XY5 22.00 Result	Q	B05XY5RE 22.00 Result	Q	B05XY6 27.00 Result	Q
BIS(2-CHLOROETHYL)ETHER	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2-CHLOROPHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
1,3-DICHLOROBENZENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
1,4-DICHLOROBENZENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
BENZYL ALCOHOL	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
1,2-DICHLOROBENZENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2-METHYLPHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
BIS(2-CHLOROISOPROPYL)ETHER	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
4-METHYLPHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
N-NITROSO-DI-N-PROPYLAMINE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
HEXACHLOROETHANE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
NITROBENZENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
ISOPHORONE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2-NITROPHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
2,4-DIMETHYLPHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
BENZOIC ACID	ug/Kg	1700.000	U	1600.000	UR	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
BIS(2-CHLOROETHOXY)METHANE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2,4-DICHLOROPHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
1,2,4-TRICHLOROBENZENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
NAPHTHALENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
4-CHLOROANILINE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
HEXACHLOROBUTADIENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
4-CHLORO-3-METHYLPHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
2-METHYLNAPHTHALENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
HEXACHLOROCYCLOPENTADIENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2,4,6-TRICHLOROPHENOL	ug/Kg	350.000	U	340.000	UR	340.000	U	340.000	UJ	340.000	U	340.000	U
2,4,5-TRICHLOROPHENOL	ug/Kg	1700.000	U	1600.000	UR	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
2-CHLORONAPHTHALENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2-NITROANILINE	ug/Kg	1700.000	U	1600.000	U	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
DIMETHYLPHTHALATE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
ACENAPHTHYLENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2,6-DINITROTOLUENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
ANILINE		N/R		N/R		N/R		N/R		N/R		N/R	
3-NITROANILINE	ug/Kg	1700.000	U	1600.000	U	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
ACENAPHTHENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2,4-DINITROPHENOL	ug/Kg	1700.000	U	1600.000	UR	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
4-NITROPHENOL	ug/Kg	1700.000	U	1600.000	UR	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
DIBENZOFURAN	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
2,4-DINITROTOLUENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U

Location 116-B-1

Parameter	Samp# / Depth	B05XY1 17.00		B05XY4 19.00		B05XY4RE 19.00		B05XY5 22.00		B05XY5RE 22.00		B05XY6 27.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
DIETHYLPHTHALATE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
4-CHLOROPHENYL-PHENYLETHER	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
FLUORENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
4-NITROANILINE	ug/Kg	1700.000	U	1600.000	U	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
4,6-DINITRO-2-METHYLPHENOL	ug/Kg	1700.000	U	1600.000	UR	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
N-NITROSODIPHENYLAMINE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
4-BROMOPHENYL-PHENYLETHER	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
HEXACHLOROBENZENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
PENTACHLOROPHENOL	ug/Kg	1700.000	U	1600.000	UR	1700.000	U	1700.000	UJ	1700.000	U	1600.000	U
PHENANTHRENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
ANTHRACENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
CARBAZOLE		N/R		N/R		N/R		N/R		N/R		N/R	
DI-N-BUTYLPHTHALATE	ug/Kg	350.000	U	340.000	U	40.000	UJ	340.000	UJ	38.000	UJ	340.000	U
FLUORANTHENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
PYRENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
BUTYLBENZYLPHTHALATE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
3,3'-DICHLOROBENZIDINE	ug/Kg	710.000	U	670.000	U	690.000	U	690.000	UJ	690.000	U	670.000	U
BENZO(A)ANTHRACENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
CHRYSENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
BIS(2-ETHYLHEXYL)PHTHALATE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
DI-N-OCTYLPHTHALATE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
BENZO(B)FLUORANTHENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
BENZO(K)FLUORANTHENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
BENZO(A)PYRENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
INDENO(1,2,3-CD)PYRENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
DIBENZ(A,H)ANTHRACENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
BENZO(G,H,I)PERYLENE	ug/Kg	350.000	U	340.000	U	340.000	U	340.000	UJ	340.000	U	340.000	U
Pesticides													
ALPHA-BHC	ug/Kg	8.300	U	8.300	U	N/R		8.200	U	N/R		8.200	U
BETA-BHC	ug/Kg	8.300	U	8.300	U	N/R		8.200	U	N/R		8.200	U
DELTA-BHC	ug/Kg	8.300	U	8.300	U	N/R		8.200	U	N/R		8.200	U
GAMMA-BHC (LINDANE)	ug/Kg	8.300	U	8.300	U	N/R		8.200	U	N/R		8.200	U
HEPTACHLOR	ug/Kg	8.300	U	8.300	U	N/R		8.200	U	N/R		8.200	U
ALDRIN	ug/Kg	8.300	U	8.300	U	N/R		8.200	U	N/R		8.200	U
HEPTACHLOR EPOXIDE	ug/Kg	8.300	U	8.300	U	N/R		8.200	U	N/R		8.200	U
ENDOSULFAN I	ug/Kg	8.300	U	8.300	U	N/R		8.200	U	N/R		8.200	U
DIELDRIN	ug/Kg	17.000	U	17.000	U	N/R		16.000	U	N/R		16.000	U
4,4'-DDE	ug/Kg	17.000	U	17.000	U	N/R		16.000	U	N/R		16.000	U
ENDRIN	ug/Kg	17.000	U	17.000	U	N/R		16.000	U	N/R		16.000	U

Location 116-B-1

Parameter	Samp# Depth	B05XY1 17.00		B05XY4 19.00		B05XY4RE 19.00		B05XY5 22.00		B05XY5RE 22.00		B05XY6 27.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
ENDOSULFAN II	ug/Kg	17.000	U	17.000	U	N/R		16.000	U	N/R		16.000	U
4,4'-DDD	ug/Kg	17.000	U	17.000	U	N/R		16.000	U	N/R		16.000	U
ENDOSULFAN SULFATE	ug/Kg	17.000	U	17.000	U	N/R		16.000	U	N/R		16.000	U
4,4'-DDT	ug/Kg	17.000	U	17.000	U	N/R		16.000	U	N/R		16.000	U
METHOXYCHLOR	ug/Kg	83.000	U	83.000	U	N/R		82.000	U	N/R		82.000	U
ENDRIN KETONE	ug/Kg	17.000	U	17.000	U	N/R		16.000	U	N/R		16.000	U
ENDRIN ALDEHYDE		N/R		N/R		N/R		N/R		N/R		N/R	
ALPHA-CHLORDANE	ug/Kg	83.000	U	83.000	U	N/R		82.000	U	N/R		82.000	U
GAMMA-CHLORDANE	ug/Kg	83.000	U	83.000	U	N/R		82.000	U	N/R		82.000	U
CHLORDANE		N/R		N/R		N/R		N/R		N/R		N/R	
TOXAPHENE	ug/Kg	170.000	U	170.000	U	N/R		160.000	U	N/R		160.000	U
AROCLOR-1016	ug/Kg	83.000	U	83.000	U	N/R		82.000	U	N/R		82.000	U
AROCLOR-1221	ug/Kg	83.000	U	83.000	U	N/R		82.000	U	N/R		82.000	U
AROCLOR-1232	ug/Kg	83.000	U	83.000	U	N/R		82.000	U	N/R		82.000	U
AROCLOR-1242	ug/Kg	83.000	U	83.000	U	N/R		82.000	U	N/R		82.000	U
AROCLOR-1248	ug/Kg	83.000	U	83.000	U	N/R		82.000	U	N/R		82.000	U
AROCLOR-1254	ug/Kg	170.000	U	170.000	U	N/R		160.000	U	N/R		160.000	U
AROCLOR-1260	ug/Kg	170.000	U	170.000	U	N/R		160.000	U	N/R		160.000	U

Location 116-B-2

Parameter	Samp# / Depth	B05Y20 12.00		B05Y21 17.80		B05Y22 22.50		B05Y23 22.50	
	Units	Result	Q	Result	Q	Result	Q	Result	Q
Volatiles									
CHLOROMETHANE	ug/Kg	11.000	U	11.000	U	11.000	U	11.000	U
BROMOMETHANE	ug/Kg	11.000	U	11.000	U	11.000	U	11.000	U
VINYL CHLORIDE	ug/Kg	11.000	U	11.000	U	11.000	U	11.000	U
CHLOROETHANE	ug/Kg	11.000	U	11.000	U	11.000	U	11.000	U
METHYLENE CHLORIDE	ug/Kg	3.000	UJ	2.000	UJ	5.000	U	5.000	U
ACETONE	ug/Kg	17.000	U	11.000	U	110.000	U	120.000	U
CARBON DISULFIDE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
1,1-DICHLOROETHENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
1,1-DICHLOROETHANE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
1,2-DICHLOROETHENE (TOTAL)	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
CHLOROFORM	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
1,2-DICHLOROETHANE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
2-BUTANONE	ug/Kg	11.000	U	11.000	U	11.000	U	11.000	U
1,1,1-TRICHLOROETHANE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
CARBON TETRACHLORIDE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
VINYL ACETATE	ug/Kg	11.000	U	11.000	U	11.000	U	11.000	U
BROMODICHLOROMETHANE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
1,2-DICHLOROPROPANE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
CIS-1,3-DICHLOROPROPENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
TRICHLOROETHENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
DIBROMOCHLOROMETHANE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
1,1,2-TRICHLOROETHANE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
BENZENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
TRANS-1,3-DICHLOROPROPENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
2-CHLOROETHOXY ETHENE		N/R		N/R		N/R		N/R	
BROMOFORM	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
4-METHYL-2-PENTANONE	ug/Kg	11.000	U	11.000	U	3.000	J	11.000	
2-HEXANONE	ug/Kg	11.000	U	11.000	U	11.000	U	11.000	U
TETRACHLOROETHENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
1,1,2,2-TETRACHLOROETHANE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
TOLUENE	ug/Kg	2.000	UJ	2.000	UJ	2.000	UJ	52.000	
CHLOROBENZENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
ETHYLBENZENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
STYRENE	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
XYLENES (TOTAL)	ug/Kg	5.000	U	5.000	U	5.000	U	5.000	U
Semi-volatiles									
PHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
ANILINE		N/R		N/R		N/R		N/R	

Location 116-B-2

Parameter	Samp# Depth	B05Y20 12.00		B05Y21 17.80		B05Y22 22.50		B05Y23 22.50	
	Units	Result	Q	Result	Q	Result	Q	Result	Q
BIS(2-CHLOROETHYL)ETHER	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2-CHLOROPHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
1,3-DICHLOROBENZENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
1,4-DICHLOROBENZENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
BENZYL ALCOHOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
1,2-DICHLOROBENZENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2-METHYLPHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
BIS(2-CHLOROISOPROPYL)ETHER	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
4-METHYLPHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
N-NITROSO-DI-N-PROPYLAMINE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
HEXACHLOROETHANE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
NITROBENZENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
ISOPHORONE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2-NITROPHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2,4-DIMETHYLPHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
BENZOIC ACID	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
BIS(2-CHLOROETHOXY)METHANE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2,4-DICHLOROPHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
1,2,4-TRICHLOROBENZENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
NAPHTHALENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
4-CHLOROANILINE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
HEXACHLOROBUTADIENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
4-CHLORO-3-METHYLPHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2-METHYLNAPHTHALENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
HEXACHLOROCYCLOPENTADIENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2,4,6-TRICHLOROPHENOL	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2,4,5-TRICHLOROPHENOL	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
2-CHLORONAPHTHALENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2-NITROANILINE	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
DIMETHYLPHTHALATE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
ACENAPHTHYLENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2,6-DINITROTOLUENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
ANILINE		N/R		N/R		N/R		N/R	
3-NITROANILINE	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
ACENAPHTHENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2,4-DINITROPHENOL	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
4-NITROPHENOL	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
DIBENZOFURAN	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
2,4-DINITROTOLUENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ

Location 116-B-2

Parameter	Samp# / Depth / Units	B05Y20 12.00 Result	Q	B05Y21 17.80 Result	Q	B05Y22 22.50 Result	Q	B05Y23 22.50 Result	Q
DIETHYLPHTHALATE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
4-CHLOROPHENYL-PHENYLETHER	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
FLUORENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
4-NITROANILINE	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
4,6-DINITRO-2-METHYLPHENOL	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
N-NITROSODIPHENYLAMINE	ug/Kg	110.000	J	350.000	U	340.000	UJ	350.000	UJ
4-BROMOPHENYL-PHENYLETHER	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
HEXACHLOROBENZENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
PENTACHLOROPHENOL	ug/Kg	1700.000	U	1700.000	U	1600.000	UJ	1700.000	UJ
PHENANTHRENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
ANTHRACENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
CARBAZOLE		N/R		N/R		N/R		N/R	
DI-N-BUTYLPHTHALATE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
FLUORANTHENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
PYRENE	ug/Kg	39.000	UJ	350.000	U	340.000	UJ	350.000	UJ
BUTYLBENZYLPHTHALATE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
3,3'-DICHLOROBENZIDINE	ug/Kg	680.000	U	710.000	U	670.000	UJ	690.000	UJ
BENZO(A)ANTHRACENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
CHRYSENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	ug/Kg	87.000	UJ	350.000	U	340.000	UJ	350.000	UJ
DI-N-OCTYLPHTHALATE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
BENZO(B)FLUORANTHENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
BENZO(K)FLUORANTHENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
BENZO(A)PYRENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
INDENO(1,2,3-CD)PYRENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
DIBENZ(A,H)ANTHRACENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
BENZO(G,H,I)PERYLENE	ug/Kg	340.000	U	350.000	U	340.000	UJ	350.000	UJ
Pesticides									
ALPHA-BHC	ug/Kg	8.400	U	8.400	U	8.200	UJ	8.600	UJ
BETA-BHC	ug/Kg	8.400	U	8.400	U	8.200	UJ	8.600	UJ
DELTA-BHC	ug/Kg	8.400	U	8.400	U	8.200	UJ	8.600	UJ
GAMMA-BHC (LINDANE)	ug/Kg	8.400	U	8.400	U	8.200	UJ	8.600	UJ
HEPTACHLOR	ug/Kg	8.400	U	8.400	U	8.200	UJ	8.600	UJ
ALDRIN	ug/Kg	8.400	U	8.400	U	8.200	UJ	8.600	UJ
HEPTACHLOR EPOXIDE	ug/Kg	8.400	U	8.400	U	8.200	UJ	8.600	UJ
ENDOSULFAN I	ug/Kg	8.400	U	8.400	U	8.200	UJ	8.600	UJ
DIELDRIN	ug/Kg	17.000	U	17.000	U	16.000	UJ	17.000	UJ
4,4'-DDE	ug/Kg	17.000	U	17.000	U	16.000	UJ	17.000	UJ
ENDRIN	ug/Kg	17.000	U	17.000	U	16.000	UJ	17.000	UJ

Location 116-B-2

Parameter	Samp# / Depth / Units	B05Y20 12.00 Result	Q	B05Y21 17.80 Result	Q	B05Y22 22.50 Result	Q	B05Y23 22.50 Result	Q
ENDOSULFAN II	ug/Kg	17.000	U	17.000	U	16.000	UJ	17.000	UJ
4,4'-DDD	ug/Kg	17.000	U	17.000	U	16.000	UJ	17.000	UJ
ENDOSULFAN SULFATE	ug/Kg	17.000	U	17.000	U	16.000	UJ	17.000	UJ
4,4'-DDT	ug/Kg	17.000	U	17.000	U	16.000	UJ	17.000	UJ
METHOXYCHLOR	ug/Kg	84.000	U	84.000	U	82.000	UJ	86.000	UJ
ENDRIN KETONE	ug/Kg	17.000	U	17.000	U	16.000	UJ	17.000	UJ
ENDRIN ALDEHYDE		N/R		N/R		N/R		N/R	
ALPHA-CHLORDANE	ug/Kg	84.000	U	84.000	U	82.000	UJ	86.000	UJ
GAMMA-CHLORDANE	ug/Kg	84.000	U	84.000	U	82.000	UJ	86.000	UJ
CHLORDANE		N/R		N/R		N/R		N/R	
TOXAPHENE	ug/Kg	170.000	U	170.000	U	160.000	UJ	170.000	UJ
AROCLOR-1016	ug/Kg	84.000	U	84.000	U	82.000	UJ	86.000	UJ
AROCLOR-1221	ug/Kg	84.000	U	84.000	U	82.000	UJ	86.000	UJ
AROCLOR-1232	ug/Kg	84.000	U	84.000	U	82.000	UJ	86.000	UJ
AROCLOR-1242	ug/Kg	84.000	U	84.000	U	82.000	UJ	86.000	UJ
AROCLOR-1248	ug/Kg	84.000	U	84.000	U	82.000	UJ	86.000	UJ
AROCLOR-1254	ug/Kg	170.000	U	170.000	U	160.000	UJ	170.000	UJ
AROCLOR-1260	ug/Kg	170.000	U	170.000	U	160.000	UJ	170.000	UJ

Location 116-B-3

Parameter	Samp# Depth / Units	B05XY8 9.40 Result	Q	B05XY8RE 9.40 Result	Q	B05XZ0 12.70 Result	Q	B05XZ0RE 12.70 Result	Q	B05XZ1 12.70 Result	Q	B05XZ3 16.80 Result	Q
Volatiles													
CHLOROMETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		11.000	U	11.000	U
BROMOMETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		11.000	U	11.000	U
VINYL CHLORIDE	ug/Kg	10.000	U	N/R		11.000	U	N/R		11.000	U	11.000	U
CHLOROETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		11.000	U	11.000	U
METHYLENE CHLORIDE	ug/Kg	10.000	U	N/R		11.000	U	N/R		28.000	U	2.000	UJ
ACETONE	ug/Kg	45.000	U	N/R		190.000	U	N/R		40.000		16.000	U
CARBON DISULFIDE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
1,1-DICHLOROETHENE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
1,1-DICHLOROETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
1,2-DICHLOROETHENE (TOTAL)	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
CHLOROFORM	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
1,2-DICHLOROETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
2-BUTANONE	ug/Kg	10.000	U	N/R		5.000	J	N/R		11.000	U	11.000	U
1,1,1-TRICHLOROETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
CARBON TETRACHLORIDE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
VINYL ACETATE	ug/Kg	N/R		N/R		N/R		N/R		11.000	U	N/R	
BROMODICHLOROMETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
1,2-DICHLOROPROPANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
CIS-1,3-DICHLOROPROPENE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
TRICHLOROETHENE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
DIBROMOCHLOROMETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
1,1,2-TRICHLOROETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
BENZENE	ug/Kg	1.000	J	N/R		11.000	U	N/R		6.000	U	11.000	U
TRANS-1,3-DICHLOROPROPENE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
2-CHLOROETHOXY ETHENE		N/R		N/R		N/R		N/R		N/R		N/R	
BROMOFORM	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
4-METHYL-2-PENTANONE	ug/Kg	10.000	U	N/R		3.000	J	N/R		11.000	U	1.000	J
2-HEXANONE	ug/Kg	10.000	U	N/R		11.000	U	N/R		11.000	U	11.000	U
TETRACHLOROETHENE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
1,1,2,2-TETRACHLOROETHANE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
TOLUENE	ug/Kg	8.000	UJ	N/R		11.000	U	N/R		6.000	U	11.000	U
CHLOROBENZENE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
ETHYLBENZENE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
STYRENE	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
XYLENES (TOTAL)	ug/Kg	10.000	U	N/R		11.000	U	N/R		6.000	U	11.000	U
Semi-volatiles													
PHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
ANILINE		N/R		N/R		N/R		N/R		N/R		N/R	

Location 116-B-3

Parameter	Samp# Depth / Units	B05XY8 9.40 Result	Q	B05XY8RE 9.40 Result	Q	B05XZ0 12.70 Result	Q	B05XZ0RE 12.70 Result	Q	B05XZ1 12.70 Result	Q	B05XZ3 16.80 Result	Q
BIS(2-CHLOROETHYL)ETHER	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2-CHLOROPHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
1,3-DICHLOROBENZENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
1,4-DICHLOROBENZENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BENZYL ALCOHOL	ug/Kg	N/R		N/R		N/R		N/R		360.000	U	N/R	
1,2-DICHLOROBENZENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2-METHYLPHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BIS(2-CHLOROISOPROPYL)ETHER	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
4-METHYLPHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
N-NITROSO-DI-N-PROPYLAMINE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
HEXACHLOROETHANE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
NITROBENZENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
ISOPHORONE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2-NITROPHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2,4-DIMETHYLPHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BENZOIC ACID	ug/Kg	N/R		N/R		N/R		N/R		1800.000	U	N/R	
BIS(2-CHLOROETHOXY)METHANE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2,4-DICHLOROPHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
1,2,4-TRICHLOROBENZENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
NAPHTHALENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
4-CHLOROANILINE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
HEXACHLOROBUTADIENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
4-CHLORO-3-METHYLPHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2-METHYLNAPHTHALENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
HEXACHLOROCYCLOPENTADIENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2,4,6-TRICHLOROPHENOL	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2,4,5-TRICHLOROPHENOL	ug/Kg	810.000	UJ	820.000	U	860.000	UJ	860.000	U	1800.000	U	840.000	UJ
2-CHLORONAPHTHALENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2-NITROANILINE	ug/Kg	810.000	UJ	820.000	U	860.000	UJ	860.000	U	1800.000	U	840.000	UJ
DIMETHYLPHTHALATE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
ACENAPHTHYLENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2,6-DINITROTOLUENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
ANILINE		N/R		N/R		N/R		N/R		N/R		N/R	
3-NITROANILINE	ug/Kg	810.000	UJ	820.000	U	860.000	UJ	860.000	U	1800.000	U	840.000	UJ
ACENAPHTHENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2,4-DINITROPHENOL	ug/Kg	810.000	UJ	820.000	U	860.000	UJ	860.000	U	1800.000	U	840.000	UJ
4-NITROPHENOL	ug/Kg	810.000	UJ	820.000	U	860.000	UJ	860.000	U	1800.000	U	840.000	UJ
DIBENZOFURAN	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
2,4-DINITROTOLUENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ

Location 116-B-3

Parameter	Samp# / Depth / Units	B05XY8 9.40 Result	Q	B05XY8RE 9.40 Result	Q	B05XZ0 12.70 Result	Q	B05XZ0RE 12.70 Result	Q	B05XZ1 12.70 Result	Q	B05XZ3 16.80 Result	Q
DIETHYLPHTHALATE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
4-CHLOROPHENYL-PHENYLETHER	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
FLUORENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
4-NITROANILINE	ug/Kg	810.000	UJ	820.000	U	860.000	UJ	860.000	U	1800.000	U	840.000	UJ
4,6-DINITRO-2-METHYLPHENOL	ug/Kg	810.000	UJ	820.000	U	860.000	UJ	860.000	U	1800.000	U	840.000	UJ
N-NITROSODIPHENYLAMINE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
4-BROMOPHENYL-PHENYLETHER	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
HEXACHLOROBENZENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
PENTACHLOROPHENOL	ug/Kg	810.000	UJ	820.000	U	860.000	UJ	860.000	U	1800.000	U	840.000	UJ
PHENANTHRENE	ug/Kg	120.000	J	100.000	J	360.000	UJ	360.000	U	360.000	U	350.000	UJ
ANTHRACENE	ug/Kg	27.000	J	20.000	J	360.000	UJ	360.000	U	360.000	U	350.000	UJ
CARBAZOLE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	N/R		350.000	UJ
DI-N-BUTYLPHTHALATE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
FLUORANTHENE	ug/Kg	310.000	J	270.000	J	360.000	UJ	360.000	U	360.000	U	350.000	UJ
PYRENE	ug/Kg	330.000	UJ	220.000	UJ	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BUTYLBENZYLPHTHALATE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
3,3'-DICHLOROBENZIDINE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	720.000	U	350.000	UJ
BENZO(A)ANTHRACENE	ug/Kg	160.000	J	150.000	J	360.000	UJ	360.000	U	360.000	U	350.000	UJ
CHRYSENE	ug/Kg	190.000	J	150.000	J	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	ug/Kg	420.000	UJ	250.000	UJ	360.000	UJ	360.000	U	360.000	U	350.000	UJ
DI-N-OCTYLPHTHALATE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BENZO(B)FLUORANTHENE	ug/Kg	89.000	J	100.000	J	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BENZO(K)FLUORANTHENE	ug/Kg	130.000	J	83.000	J	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BENZO(A)PYRENE	ug/Kg	97.000	J	96.000	J	360.000	UJ	360.000	U	360.000	U	350.000	UJ
INDENO(1,2,3-CD)PYRENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
DIBENZ(A,H)ANTHRACENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
BENZO(G,H,I)PERYLENE	ug/Kg	330.000	UJ	340.000	U	360.000	UJ	360.000	U	360.000	U	350.000	UJ
Pesticides													
ALPHA-BHC	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		8.900	U	1.800	UJ
BETA-BHC	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		8.900	U	1.800	UJ
DELTA-BHC	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		8.900	U	1.800	UJ
GAMMA-BHC (LINDANE)	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		8.900	U	1.800	UJ
HEPTACHLOR	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		8.900	U	1.800	UJ
ALDRIN	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		8.900	U	1.800	UJ
HEPTACHLOR EPOXIDE	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		8.900	U	1.800	UJ
ENDOSULFAN I	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		8.900	U	1.800	UJ
DIELDRIN	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		18.000	U	3.500	UJ
4,4'-DDE	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		18.000	U	3.500	UJ
ENDRIN	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		18.000	U	3.500	UJ

Location 116-B-3

Parameter	Samp# Depth	B05XY8 9.40		B05XY8RE 9.40		B05XZ0 12.70		B05XZ0RE 12.70		B05XZ1 12.70		B05XZ3 16.80	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
ENDOSULFAN II	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		18.000	U	3.500	UJ
4,4'-DDD	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		18.000	U	3.500	UJ
ENDOSULFAN SULFATE	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		18.000	U	3.500	UJ
4,4'-DDT	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		18.000	U	3.500	UJ
METHOXYCHLOR	ug/Kg	18.000	UJ	N/R		18.000	UJ	N/R		89.000	U	18.000	UJ
ENDRIN KETONE	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		18.000	U	3.500	UJ
ENDRIN ALDEHYDE	ug/Kg	3.400	UJ	N/R		3.600	UJ	N/R		N/R		3.500	UJ
ALPHA-CHLORDANE	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		89.000	U	1.800	UJ
GAMMA-CHLORDANE	ug/Kg	1.800	UJ	N/R		1.800	UJ	N/R		89.000	U	1.800	UJ
CHLORDANE		N/R		N/R		N/R		N/R		N/R		N/R	
TOXAPHENE	ug/Kg	180.000	UJ	N/R		180.000	UJ	N/R		180.000	U	180.000	UJ
AROCLOR-1016	ug/Kg	34.000	UJ	N/R		36.000	UJ	N/R		89.000	U	35.000	UJ
AROCLOR-1221	ug/Kg	69.000	UJ	N/R		73.000	UJ	N/R		89.000	U	71.000	UJ
AROCLOR-1232	ug/Kg	34.000	UJ	N/R		36.000	UJ	N/R		89.000	U	35.000	UJ
AROCLOR-1242	ug/Kg	34.000	UJ	N/R		36.000	UJ	N/R		89.000	U	35.000	UJ
AROCLOR-1248	ug/Kg	34.000	UJ	N/R		36.000	UJ	N/R		89.000	U	35.000	UJ
AROCLOR-1254	ug/Kg	34.000	UJ	N/R		36.000	UJ	N/R		180.000	U	35.000	UJ
AROCLOR-1260	ug/Kg	34.000	UJ	N/R		36.000	UJ	N/R		180.000	U	35.000	UJ

Location 116-B-5

Parameter	Samp# Depth / Units	B05Y24 8.60 Result	Q	B05Y25 11.20 Result	Q	B05Y25RE 11.20 Result	Q	B05Y26 17.00 Result	Q
Volatiles									
CHLOROMETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
BROMOMETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
VINYL CHLORIDE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
CHLOROETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
METHYLENE CHLORIDE	ug/Kg	31.000	U	N/R		85.000	UJ	10.000	U
ACETONE	ug/Kg	24.000	U	N/R		64.000	UJ	17.000	U
CARBON DISULFIDE	ug/Kg	4.000	J	N/R		200.000	J	10.000	U
1,1-DICHLOROETHENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
1,1-DICHLOROETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
1,2-DICHLOROETHENE (TOTAL)	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
CHLOROFORM	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
1,2-DICHLOROETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
2-BUTANONE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
1,1,1-TRICHLOROETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
CARBON TETRACHLORIDE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
VINYL ACETATE		N/R		N/R		N/R		N/R	
BROMODICHLOROMETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
1,2-DICHLOROPROPANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
CIS-1,3-DICHLOROPROPENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
TRICHLOROETHENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
DIBROMOCHLOROMETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
1,1,2-TRICHLOROETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
BENZENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
TRANS-1,3-DICHLOROPROPENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
2-CHLOROETHOXY ETHENE		N/R		N/R		N/R		N/R	
BROMOFORM	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
4-METHYL-2-PENTANONE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
2-HEXANONE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
TETRACHLOROETHENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
1,1,2,2-TETRACHLOROETHANE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
TOLUENE	ug/Kg	25.000		N/R		77.000	J	10.000	U
CHLOROBENZENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
ETHYLBENZENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
STYRENE	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
XYLENES (TOTAL)	ug/Kg	10.000	U	11.000	U	53.000	UJ	10.000	U
Semi-volatiles									
PHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
ANILINE		N/R		N/R		N/R		N/R	

Location 116-B-5

Parameter	Samp# Depth	B05Y24 8.60		B05Y25 11.20		B05Y25RE 11.20		B05Y26 17.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q
BIS(2-CHLOROETHYL)ETHER	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2-CHLOROPHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
1,3-DICHLOROBENZENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
1,4-DICHLOROBENZENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BENZYL ALCOHOL		N/R		N/R		N/R		N/R	
1,2-DICHLOROBENZENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2-METHYLPHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BIS(2-CHLOROISOPROPYL)ETHER	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
4-METHYLPHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
N-NITROSO-DI-N-PROPYLAMINE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
HEXACHLOROETHANE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
NITROBENZENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
ISOPHORONE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2-NITROPHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2,4-DIMETHYLPHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BENZOIC ACID		N/R		N/R		N/R		N/R	
BIS(2-CHLOROETHOXY)METHANE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2,4-DICHLOROPHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
1,2,4-TRICHLOROBENZENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
NAPHTHALENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
4-CHLOROANILINE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
HEXACHLOROBUTADIENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
4-CHLORO-3-METHYLPHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2-METHYLNAPHTHALENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
HEXACHLOROCYCLOPENTADIENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2,4,6-TRICHLOROPHENOL	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2,4,5-TRICHLOROPHENOL	ug/Kg	820.000	UJ	840.000	U	N/R		830.000	U
2-CHLORONAPHTHALENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2-NITROANILINE	ug/Kg	820.000	UJ	840.000	U	N/R		830.000	U
DIMETHYLPHTHALATE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
ACENAPHTHYLENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2,6-DINITROTOLUENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
ANILINE		N/R		N/R		N/R		N/R	
3-NITROANILINE	ug/Kg	820.000	UJ	840.000	U	N/R		830.000	U
ACENAPHTHENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2,4-DINITROPHENOL	ug/Kg	820.000	UJ	840.000	U	N/R		830.000	U
4-NITROPHENOL	ug/Kg	820.000	UJ	840.000	U	N/R		830.000	U
DIBENZOFURAN	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
2,4-DINITROTOLUENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U

Location 116-B-5

Parameter	Samp# Depth / Units	B0SY24 8.60 Result	Q	B0SY25 11.20 Result	Q	B0SY25RE 11.20 Result	Q	B0SY26 17.00 Result	Q
DIETHYLPHTHALATE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
4-CHLOROPHENYL-PHENYLETHER	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
FLUORENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
4-NITROANILINE	ug/Kg	820.000	UJ	840.000	U	N/R		830.000	U
4,6-DINITRO-2-METHYLPHENOL	ug/Kg	820.000	UJ	840.000	U	N/R		830.000	U
N-NITROSODIPHENYLAMINE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
4-BROMOPHENYL-PHENYLETHER	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
HEXACHLOROBENZENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
PENTACHLOROPHENOL	ug/Kg	820.000	UJ	840.000	U	N/R		830.000	U
PHENANTHRENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
ANTHRACENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
CARBAZOLE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
DI-N-BUTYLPHTHALATE	ug/Kg	20.000	UJ	350.000	U	N/R		340.000	U
FLUORANTHENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
PYRENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BUTYLBENZYLPHTHALATE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
3,3'-DICHLOROBENZIDINE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BENZO(A)ANTHRACENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
CHRYSENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BIS(2-ETHYLHEXYL)PHTHALATE	ug/Kg	71.000	UJ	560.000	U	N/R		340.000	U
DI-N-OCTYLPHTHALATE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BENZO(B)FLUORANTHENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BENZO(K)FLUORANTHENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BENZO(A)PYRENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
INDENO(1,2,3-CD)PYRENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
DIBENZ(A,H)ANTHRACENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
BENZO(G,H,I)PERYLENE	ug/Kg	340.000	UJ	350.000	U	N/R		340.000	U
Pesticides									
ALPHA-BHC	ug/Kg	1.700	UJ	1.800	UJ	N/R		1.700	UJ
BETA-BHC	ug/Kg	1.700	UJ	1.800	U	N/R		1.700	U
DELTA-BHC	ug/Kg	1.700	UJ	1.800	UJ	N/R		1.700	UJ
GAMMA-BHC (LINDANE)	ug/Kg	1.700	UJ	1.800	UJ	N/R		1.700	UJ
HEPTACHLOR	ug/Kg	1.700	UJ	1.800	UJ	N/R		1.700	UJ
ALDRIN	ug/Kg	1.700	UJ	1.800	UJ	N/R		1.700	UJ
HEPTACHLOR EPOXIDE	ug/Kg	1.700	UJ	1.800	UJ	N/R		1.700	UJ
ENDOSULFAN I	ug/Kg	1.700	UJ	1.800	UJ	N/R		1.700	UJ
DIELDRIN	ug/Kg	3.400	UJ	3.500	UJ	N/R		3.300	UJ
4,4'-DDE	ug/Kg	3.400	UJ	3.500	UJ	N/R		3.300	UJ
ENDRIN	ug/Kg	3.400	UJ	3.500	UJ	N/R		3.300	UJ

Location 116-B-5

Parameter	Samp# Depth	B05Y24 8.60		B05Y25 11.20		B05Y25RE 11.20		B05Y26 17.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q
ENDOSULFAN II	ug/Kg	3.400	UJ	3.500	U	N/R		3.300	U
4,4'-DDD	ug/Kg	3.400	UJ	3.500	UJ	N/R		3.300	UJ
ENDOSULFAN SULFATE	ug/Kg	3.400	UJ	3.500	U	N/R		3.300	U
4,4'-DDT	ug/Kg	3.400	UJ	3.500	UJ	N/R		3.300	UJ
METHOXYCHLOR	ug/Kg	17.000	UJ	18.000	UJ	N/R		17.000	UJ
ENDRIN KETONE	ug/Kg	3.400	UJ	3.500	U	N/R		3.300	U
ENDRIN ALDEHYDE	ug/Kg	3.400	UJ	3.500	U	N/R		3.300	U
ALPHA-CHLORDANE	ug/Kg	1.700	UJ	1.800	U	N/R		1.700	U
GAMMA-CHLORDANE	ug/Kg	1.700	UJ	1.800	UJ	N/R		1.700	UJ
CHLORDANE		N/R		N/R		N/R		N/R	
TOXAPHENE	ug/Kg	170.000	UJ	180.000	U	N/R		170.000	U
AROCLOR-1016	ug/Kg	34.000	UJ	35.000	U	N/R		33.000	U
AROCLOR-1221	ug/Kg	68.000	UJ	70.000	U	N/R		68.000	U
AROCLOR-1232	ug/Kg	34.000	UJ	35.000	U	N/R		33.000	U
AROCLOR-1242	ug/Kg	34.000	UJ	35.000	U	N/R		33.000	U
AROCLOR-1248	ug/Kg	34.000	UJ	35.000	U	N/R		33.000	U
AROCLOR-1254	ug/Kg	34.000	UJ	35.000	U	N/R		33.000	U
AROCLOR-1260	ug/Kg	34.000	UJ	35.000	U	N/R		33.000	U

Location 116-C-5

Parameter	Samp# Depth / Units	B018V0 0.00 Result	Q	B018V1A 0.00 Result	Q	B018V2 0.00 Result	Q	B018V3 0.00 Result	Q	B018V4 0.00 Result	Q	B018V4RE 0.00 Result	Q
Volatiles													
CHLOROMETHANE	ug/Kg	12.000	U	11.000	U	11.000	U	11.000	U	11.000	U	N/R	
BROMOMETHANE	ug/Kg	12.000	U	11.000	U	11.000	U	11.000	U	11.000	U	N/R	
VINYL CHLORIDE	ug/Kg	12.000	U	11.000	U	11.000	U	11.000	U	11.000	U	N/R	
CHLOROETHANE	ug/Kg	12.000	U	11.000	U	11.000	U	11.000	U	11.000	U	N/R	
METHYLENE CHLORIDE	ug/Kg	36.000	U	3.000	UJ	47.000	U	15.000	U	20.000	U	N/R	
ACETONE	ug/Kg	12.000	U	11.000	U	22.000	U	48.000	U	29.000	U	N/R	
CARBON DISULFIDE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
1,1-DICHLOROETHENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
1,1-DICHLOROETHANE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
1,2-DICHLOROETHENE (TOTAL)	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
CHLOROFORM	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
1,2-DICHLOROETHANE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
2-BUTANONE	ug/Kg	12.000	U	11.000	U	11.000	U	11.000	U	5.000	J	N/R	
1,1,1-TRICHLOROETHANE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
CARBON TETRACHLORIDE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
VINYL ACETATE	ug/Kg	N/R		11.000	U	N/R		N/R		N/R		N/R	
BROMODICHLOROMETHANE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
1,2-DICHLOROPROPANE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
CIS-1,3-DICHLOROPROPENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
TRICHLOROETHENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
DIBROMOCHLOROMETHANE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
1,1,2-TRICHLOROETHANE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
BENZENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
TRANS-1,3-DICHLOROPROPENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
2-CHLOROETHOXY ETHENE		N/R		N/R		N/R		N/R		N/R		N/R	
BROMOFORM	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
4-METHYL-2-PENTANONE	ug/Kg	12.000	U	11.000	U	11.000	U	11.000	U	11.000	U	N/R	
2-HEXANONE	ug/Kg	12.000	U	11.000	U	11.000	U	11.000	U	11.000	U	N/R	
TETRACHLOROETHENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
1,1,2,2-TETRACHLOROETHANE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
TOLUENE	ug/Kg	12.000	U	2.000	UJ	3.000	UJ	8.000	UJ	6.000	UJ	N/R	
CHLOROBENZENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
ETHYLBENZENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
STYRENE	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
XYLENES (TOTAL)	ug/Kg	12.000	U	6.000	U	11.000	U	11.000	U	11.000	U	N/R	
Semi-volatiles													
PHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	U
ANILINE		N/R		N/R		N/R		N/R		N/R		N/R	

Location 116-C-5

Parameter	Samp# / Depth / Units	B018V0 0.00 Result	Q	B018V1A 0.00 Result	Q	B018V2 0.00 Result	Q	B018V3 0.00 Result	Q	B018V4 0.00 Result	Q	B018V4RE 0.00 Result	Q
BIS(2-CHLOROETHYL)ETHER	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2-CHLOROPHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
1,3 DICHLOROBENZENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
1,4-DICHLOROBENZENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
BENZYL ALCOHOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		N/R		N/R	
1,2-DICHLOROBENZENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2-METHYLPHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
BIS(2-CHLOROISOPROPYL)ETHER	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
4-METHYLPHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
N-NITROSO-DI-N-PROPYLAMINE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
HEXACHLOROETHANE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
NITROBENZENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
ISOPHORONE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2-NITROPHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2,4-DIMETHYLPHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
BENZOIC ACID	ug/Kg	N/R		1800.000	UJ	N/R		N/R		N/R		N/R	
BIS(2-CHLOROETHOXY)METHANE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2,4-DICHLOROPHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
1,2,4-TRICHLOROBENZENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
NAPHTHALENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
4-CHLOROANILINE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
HEXACHLOROBUTADIENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
4-CHLORO-3-METHYLPHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2-METHYLNAPHTHALENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
HEXACHLOROCYCLOPENTADIENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2,4,6-TRICHLOROPHENOL	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2,4,5-TRICHLOROPHENOL	ug/Kg	N/R		1800.000	UJ	N/R		N/R		890.000	U	900.000	UJ
2-CHLORONAPHTHALENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2-NITROANILINE	ug/Kg	N/R		1800.000	UJ	N/R		N/R		890.000	U	900.000	UJ
DIMETHYLPHTHALATE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
ACENAPHTHYLENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2,6-DINITROTOLUENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
ANILINE		N/R		N/R		N/R		N/R		N/R		N/R	
3-NITROANILINE	ug/Kg	N/R		1800.000	UJ	N/R		N/R		890.000	U	900.000	UJ
ACENAPHTHENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2,4-DINITROPHENOL	ug/Kg	N/R		1800.000	UJ	N/R		N/R		890.000	U	900.000	UJ
4-NITROPHENOL	ug/Kg	N/R		1800.000	UJ	N/R		N/R		890.000	U	900.000	UJ
DIBENZOFURAN	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
2,4-DINITROTOLUENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ

Location 116-C-5

Parameter	Samp# Depth	B018V0 0.00		B018V1A 0.00		B018V2 0.00		B018V3 0.00		B018V4 0.00		B018V4RE 0.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
DIETHYLPHTHALATE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	68.000	UJ
4-CHLOROPHENYL-PHENYLETHER	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
FLUORENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
4-NITROANILINE	ug/Kg	N/R		1800.000	UJ	N/R		N/R		890.000	U	900.000	UJ
4,6-DINITRO-2-METHYLPHENOL	ug/Kg	N/R		1800.000	UJ	N/R		N/R		890.000	U	900.000	UJ
N-NITROSODIPHENYLAMINE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
4-BROMOPHENYL-PHENYLETHER	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
HEXACHLOROBENZENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
PENTACHLOROPHENOL	ug/Kg	N/R		1800.000	UJ	N/R		N/R		890.000	U	900.000	UJ
PHENANTHRENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
ANTHRACENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
CARBAZOLE	ug/Kg	N/R		N/R		N/R		N/R		370.000	U	370.000	UJ
DI-N-BUTYLPHTHALATE	ug/Kg	N/R		370.000	UJ	N/R		N/R		N/R		2700.000	UJ
FLUORANTHENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	46.000	J
PYRENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	52.000	UJ
BUTYLBENZYLPHTHALATE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
3,3'-DICHLOROBENZIDINE	ug/Kg	N/R		740.000	UJ	N/R		N/R		370.000	U	370.000	UJ
BENZO(A)ANTHRACENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
CHRYSENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	UJ	370.000	UJ
DI-N-OCTYLPHTHALATE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
BENZO(B)FLUORANTHENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
BENZO(K)FLUORANTHENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	42.000	J
BENZO(A)PYRENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
INDENO(1,2,3-CD)PYRENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
DIBENZ(A,H)ANTHRACENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
BENZO(G,H,I)PERYLENE	ug/Kg	N/R		370.000	UJ	N/R		N/R		370.000	U	370.000	UJ
Pesticides													
ALPHA-BHC	ug/Kg	N/R		8.700	UJ	N/R		N/R		1.900	UJ	N/R	
BETA-BHC	ug/Kg	N/R		8.700	UJ	N/R		N/R		1.900	UJ	N/R	
DELTA-BHC	ug/Kg	N/R		8.700	UJ	N/R		N/R		1.900	UJ	N/R	
GAMMA-BHC (LINDANE)	ug/Kg	N/R		8.700	UJ	N/R		N/R		1.900	UJ	N/R	
HEPTACHLOR	ug/Kg	N/R		8.700	UJ	N/R		N/R		1.900	UJ	N/R	
ALDRIN	ug/Kg	N/R		8.700	UJ	N/R		N/R		1.900	UJ	N/R	
HEPTACHLOR EPOXIDE	ug/Kg	N/R		8.700	UJ	N/R		N/R		1.900	UJ	N/R	
ENDOSULFAN I	ug/Kg	N/R		8.700	UJ	N/R		N/R		1.900	UJ	N/R	
DIELDRIN	ug/Kg	N/R		17.000	UJ	N/R		N/R		3.700	UJ	N/R	
4,4'-DDE	ug/Kg	N/R		17.000	UJ	N/R		N/R		3.700	UJ	N/R	
ENDRIN	ug/Kg	N/R		17.000	UJ	N/R		N/R		3.700	UJ	N/R	

Location 116-C-5

Parameter	Samp# Depth / Units	B018V0 0.00 Result	Q	B018V1A 0.00 Result	Q	B018V2 0.00 Result	Q	B018V3 0.00 Result	Q	B018V4 0.00 Result	Q	B018V4RE 0.00 Result	Q
ENDOSULFAN II	ug/Kg	N/R		17.000	UJ	N/R		N/R		3.700	UJ	N/R	
4,4'-DDD	ug/Kg	N/R		17.000	UJ	N/R		N/R		3.700	UJ	N/R	
ENDOSULFAN SULFATE	ug/Kg	N/R		17.000	UJ	N/R		N/R		3.700	UJ	N/R	
4,4'-DDT	ug/Kg	N/R		17.000	UJ	N/R		N/R		3.700	UJ	N/R	
METHOXYCHLOR	ug/Kg	N/R		87.000	UJ	N/R		N/R		19.000	UJ	N/R	
ENDRIN KETONE	ug/Kg	N/R		17.000	UJ	N/R		N/R		3.700	UJ	N/R	
ENDRIN ALDEHYDE	ug/Kg	N/R		N/R		N/R		N/R		3.700	UJ	N/R	
ALPHA-CHLORDANE	ug/Kg	N/R		87.000	UJ	N/R		N/R		1.900	UJ	N/R	
GAMMA-CHLORDANE	ug/Kg	N/R		87.000	UJ	N/R		N/R		1.900	UJ	N/R	
CHLORDANE		N/R		N/R		N/R		N/R		N/R		N/R	
TOXAPHENE	ug/Kg	N/R		170.000	UJ	N/R		N/R		190.000	UJ	N/R	
AROCLOR-1016	ug/Kg	N/R		87.000	UJ	N/R		N/R		37.000	UJ	N/R	
AROCLOR-1221	ug/Kg	N/R		87.000	UJ	N/R		N/R		74.000	UJ	N/R	
AROCLOR-1232	ug/Kg	N/R		87.000	UJ	N/R		N/R		37.000	UJ	N/R	
AROCLOR-1242	ug/Kg	N/R		87.000	UJ	N/R		N/R		37.000	UJ	N/R	
AROCLOR-1248	ug/Kg	N/R		87.000	UJ	N/R		N/R		37.000	UJ	N/R	
AROCLOR-1254	ug/Kg	N/R		170.000	UJ	N/R		N/R		37.000	UJ	N/R	
AROCLOR-1260	ug/Kg	N/R		170.000	UJ	N/R		N/R		37.000	UJ	N/R	

Location 116-C-5

Parameter	Samp# / Depth	B018V5 0.00		B018V5RE 0.00		B018V6A 0.00		B018V7A 0.00		B018V8A 0.00		B018X1 1.50	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Volatiles													
CHLOROMETHANE	ug/Kg	11.000	U	N/R		11.000	U	11.000	U	11.000	U	10.000	U
BROMOMETHANE	ug/Kg	11.000	U	N/R		11.000	U	11.000	U	11.000	U	10.000	U
VINYL CHLORIDE	ug/Kg	11.000	U	N/R		11.000	U	11.000	U	11.000	U	10.000	U
CHLOROETHANE	ug/Kg	11.000	U	N/R		11.000	U	11.000	U	11.000	U	10.000	U
METHYLENE CHLORIDE	ug/Kg	18.000	U	N/R		6.000	U	11.000	U	11.000	U	5.000	U
ACETONE	ug/Kg	29.000	U	N/R		23.000	U	34.000	U	24.000	U	10.000	U
CARBON DISULFIDE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
1,1-DICHLOROETHENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
1,1-DICHLOROETHANE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
1,2-DICHLOROETHENE (TOTAL)	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
CHLOROFORM	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	1.000	U
1,2-DICHLOROETHANE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
2-BUTANONE	ug/Kg	11.000	U	N/R		11.000	U	11.000	U	11.000	U	10.000	U
1,1,1-TRICHLOROETHANE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
CARBON TETRACHLORIDE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
VINYL ACETATE	ug/Kg	N/R		N/R		11.000	U	11.000	U	11.000	U	N/R	
BROMODICHLOROMETHANE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
1,2-DICHLOROPROPANE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
CIS-1,3-DICHLOROPROPENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
TRICHLOROETHENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
DIBROMOCHLOROMETHANE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
1,1,2-TRICHLOROETHANE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
BENZENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
TRANS-1,3-DICHLOROPROPENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
2-CHLOROETHOXY ETHENE		N/R		N/R		N/R		N/R		N/R		N/R	
BROMOFORM	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
4-METHYL-2-PENTANONE	ug/Kg	11.000	U	N/R		11.000	U	11.000	U	11.000	U	10.000	U
2-HEXANONE	ug/Kg	11.000	U	N/R		11.000	U	11.000	U	11.000	U	10.000	U
TETRACHLOROETHENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
1,1,2,2-TETRACHLOROETHANE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
TOLUENE	ug/Kg	1.000	UJ	N/R		2.000	UJ	2.000	UJ	4.000	UJ	2.000	UJ
CHLOROBENZENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
ETHYLBENZENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
STYRENE	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
XYLENES (TOTAL)	ug/Kg	11.000	U	N/R		6.000	U	6.000	U	6.000	U	10.000	U
Semi-volatiles													
PHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
ANILINE		N/R		N/R		N/R		N/R		N/R		N/R	

Location 116-C-5

Parameter	Samp# / Depth	B018V5 0.00		B018V5RE 0.00		B018V6A 0.00		B018V7A 0.00		B018V8A 0.00		B018X1 1.50	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
BIS(2-CHLOROETHYL)ETHER	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2-CHLOROPHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
1,3-DICHLOROBENZENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
1,4-DICHLOROBENZENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
BENZYL ALCOHOL	ug/Kg	N/R		N/R		360.000	UJ	360.000	UJ	380.000	UJ	N/R	
1,2-DICHLOROBENZENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2-METHYLPHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
BIS(2-CHLOROISOPROPYL)ETHER	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
4-METHYLPHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
N-NITROSO-DI-N-PROPYLAMINE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
HEXACHLOROETHANE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
NITROBENZENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
ISOPHORONE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2-NITROPHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2,4-DIMETHYLPHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
BENZOIC ACID	ug/Kg	N/R		N/R		1800.000	UJ	1800.000	UJ	1900.000	UJ	N/R	
BIS(2-CHLOROETHOXY)METHANE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2,4-DICHLOROPHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
1,2,4-TRICHLOROBENZENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
NAPHTHALENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
4-CHLOROANILINE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
HEXACHLOROBUTADIENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
4-CHLORO-3-METHYLPHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2-METHYLNAPHTHALENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
HEXACHLOROCYCLOPENTADIENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2,4,6-TRICHLOROPHENOL	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2,4,5-TRICHLOROPHENOL	ug/Kg	910.000	U	900.000	UJ	1800.000	UJ	1800.000	UJ	1900.000	UJ	N/R	
2-CHLORONAPHTHALENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2-NITROANILINE	ug/Kg	910.000	U	900.000	UJ	1800.000	UJ	1800.000	UJ	1900.000	UJ	N/R	
DIMETHYLPHTHALATE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
ACENAPHTHYLENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2,6-DINITROTOLUENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
ANILINE		N/R		N/R		N/R		N/R		N/R		N/R	
3-NITROANILINE	ug/Kg	910.000	U	900.000	UJ	1800.000	UJ	1800.000	UJ	1900.000	UJ	N/R	
ACENAPHTHENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2,4-DINITROPHENOL	ug/Kg	910.000	U	900.000	UJ	1800.000	UJ	1800.000	UJ	1900.000	UJ	N/R	
4-NITROPHENOL	ug/Kg	910.000	U	900.000	UJ	1800.000	UJ	1800.000	UJ	1900.000	UJ	N/R	
DIBENZOFURAN	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
2,4-DINITROTOLUENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	

Location 116-C-5

Parameter	Samp# / Depth	B018V5 0.00		B018V5RE 0.00		B018V6A 0.00		B018V7A 0.00		B018V8A 0.00		B018X1 1.50	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
DIETHYLPHTHALATE	ug/Kg	N/R		370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
4-CHLOROPHENYL-PHENYLETHER	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
FLUORENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
4-NITROANILINE	ug/Kg	910.000	U	900.000	UJ	1800.000	UJ	1800.000	UJ	1900.000	UJ	N/R	
4,6-DINITRO-2-METHYLPHENOL	ug/Kg	910.000	U	900.000	UJ	1800.000	UJ	1800.000	UJ	1900.000	UJ	N/R	
N-NITROSODIPHENYLAMINE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
4-BROMOPHENYL-PHENYLETHER	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
HEXACHLOROBENZENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
PENTACHLOROPHENOL	ug/Kg	910.000	U	900.000	UJ	920.000	J	1800.000	UJ	770.000	J	N/R	
PHENANTHRENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
ANTHRACENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
CARBAZOLE	ug/Kg	370.000	U	370.000	UJ	N/R		N/R		N/R		N/R	
DI-N-BUTYLPHTHALATE	ug/Kg	N/R		2300.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
FLUORANTHENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	67.000	J	380.000	UJ	N/R	
PYRENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	65.000	UJ	380.000	UJ	N/R	
BUTYLBENZYLPHTHALATE	ug/Kg	N/R		370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
3,3'-DICHLOROBENZIDINE	ug/Kg	370.000	U	370.000	UJ	720.000	UJ	730.000	UJ	750.000	UJ	N/R	
BENZO(A)ANTHRACENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	77.000	J	380.000	UJ	N/R	
CHRYSENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	100.000	J	380.000	UJ	N/R	
BIS(2-ETHYLHEXYL)PHTHALATE	ug/Kg	370.000	UJ	370.000	UJ	1200.000	UJ	360.000	UJ	880.000	U	N/R	
DI-N-OCTYLPHTHALATE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
BENZO(B)FLUORANTHENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	100.000	J	54.000	J	N/R	
BENZO(K)FLUORANTHENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	100.000	J	44.000	J	N/R	
BENZO(A)PYRENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
INDENO(1,2,3-CD)PYRENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
DIBENZ(A,H)ANTHRACENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
BENZO(G,H,I)PERYLENE	ug/Kg	370.000	U	370.000	UJ	360.000	UJ	360.000	UJ	380.000	UJ	N/R	
Pesticides													
ALPHA-BHC	ug/Kg	1.900	UJ	N/R		8.700	UJ	8.600	UJ	8.800	UJ	N/R	
BETA-BHC	ug/Kg	1.900	UJ	N/R		8.700	UJ	8.600	UJ	8.800	UJ	N/R	
DELTA-BHC	ug/Kg	1.900	UJ	N/R		8.700	UJ	8.600	UJ	8.800	UJ	N/R	
GAMMA-BHC (LINDANE)	ug/Kg	1.900	UJ	N/R		8.700	UJ	8.600	UJ	8.800	UJ	N/R	
HEPTACHLOR	ug/Kg	1.900	UJ	N/R		8.700	UJ	8.600	UJ	8.800	UJ	N/R	
ALDRIN	ug/Kg	1.900	UJ	N/R		8.700	UJ	8.600	UJ	8.800	UJ	N/R	
HEPTACHLOR EPOXIDE	ug/Kg	1.900	UJ	N/R		8.700	UJ	8.600	UJ	8.800	UJ	N/R	
ENDOSULFAN I	ug/Kg	1.900	UJ	N/R		8.700	UJ	8.600	UJ	8.800	UJ	N/R	
DIELDRIN	ug/Kg	3.700	UJ	N/R		17.000	UJ	17.000	UJ	18.000	UJ	N/R	
4,4'-DDE	ug/Kg	3.700	UJ	N/R		17.000	UJ	17.000	UJ	18.000	UJ	N/R	
ENDRIN	ug/Kg	3.700	UJ	N/R		17.000	UJ	17.000	UJ	18.000	UJ	N/R	

Location 116-C-5

Parameter	Samp# Depth	B018V5 0.00		B018V5RE 0.00		B018V6A 0.00		B018V7A 0.00		B018V8A 0.00		B018X1 1.50	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
ENDOSULFAN II	ug/Kg	3.700	UJ	N/R		17.000	UJ	17.000	UJ	18.000	UJ	N/R	
4,4'-DDD	ug/Kg	3.700	UJ	N/R		17.000	UJ	17.000	UJ	18.000	UJ	N/R	
ENDOSULFAN SULFATE	ug/Kg	3.700	UJ	N/R		17.000	UJ	17.000	UJ	18.000	UJ	N/R	
4,4'-DDT	ug/Kg	3.700	UJ	N/R		17.000	UJ	17.000	UJ	18.000	UJ	N/R	
METHOXYCHLOR	ug/Kg	19.000	UJ	N/R		87.000	UJ	86.000	UJ	88.000	UJ	N/R	
ENDRIN KETONE	ug/Kg	3.700	UJ	N/R		17.000	UJ	17.000	UJ	18.000	UJ	N/R	
ENDRIN ALDEHYDE	ug/Kg	3.700	UJ	N/R		N/R		N/R		N/R		N/R	
ALPHA-CHLORDANE	ug/Kg	1.900	UJ	N/R		87.000	UJ	86.000	UJ	88.000	UJ	N/R	
GAMMA-CHLORDANE	ug/Kg	1.900	UJ	N/R		87.000	UJ	86.000	UJ	88.000	UJ	N/R	
CHLORDANE		N/R		N/R		N/R		N/R		N/R		N/R	
TOXAPHENE	ug/Kg	190.000	UJ	N/R		170.000	UJ	170.000	UJ	180.000	UJ	N/R	
AROCLOR-1016	ug/Kg	37.000	UJ	N/R		87.000	UJ	86.000	UJ	88.000	UJ	N/R	
AROCLOR-1221	ug/Kg	76.000	UJ	N/R		87.000	UJ	86.000	UJ	88.000	UJ	N/R	
AROCLOR-1232	ug/Kg	37.000	UJ	N/R		87.000	UJ	86.000	UJ	88.000	UJ	N/R	
AROCLOR-1242	ug/Kg	37.000	UJ	N/R		87.000	UJ	86.000	UJ	88.000	UJ	N/R	
AROCLOR-1248	ug/Kg	37.000	UJ	N/R		87.000	UJ	86.000	UJ	88.000	UJ	N/R	
AROCLOR-1254	ug/Kg	37.000	UJ	N/R		170.000	UJ	170.000	UJ	180.000	UJ	N/R	
AROCLOR-1260	ug/Kg	37.000	UJ	N/R		170.000	UJ	170.000	UJ	180.000	UJ	N/R	

Location 116-C-5

Parameter	Samp# / Depth	B018X2 5.00		B018X3 10.00		B018X4 15.00		B018X5 20.00		B018X6 20.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Volatiles											
CHLOROMETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	11.000	U
BROMOMETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	11.000	U
VINYL CHLORIDE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	11.000	U
CHLOROETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	11.000	U
METHYLENE CHLORIDE	ug/Kg	N/R		8.000	U	11.000	U	11.000	U	1.000	U
ACETONE	ug/Kg	N/R		13.000	U	9.000	UJ	14.000	U	11.000	U
CARBON DISULFIDE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
1,1-DICHLOROETHENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
1,1-DICHLOROETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
1,2-DICHLOROETHENE (TOTAL)	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
CHLOROFORM	ug/Kg	N/R		2.000	U	1.000	U	11.000	U	6.000	U
1,2-DICHLOROETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
2-BUTANONE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	11.000	U
1,1,1-TRICHLOROETHANE	ug/Kg	N/R		2.000	U	11.000	U	11.000	U	6.000	U
CARBON TETRACHLORIDE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
VINYL ACETATE	ug/Kg	N/R		N/R		N/R		N/R		11.000	U
BROMODICHLOROMETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
1,2-DICHLOROPROPANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
CIS-1,3-DICHLOROPROPENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
TRICHLOROETHENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
DIBROMOCHLOROMETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
1,1,2-TRICHLOROETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
BENZENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
TRANS-1,3-DICHLOROPROPENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
2-CHLOROETHOXY ETHENE		N/R		N/R		N/R		N/R		N/R	
BROMOFORM	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	U
4-METHYL-2-PENTANONE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	11.000	U
2-HEXANONE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	11.000	UJ
TETRACHLOROETHENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	UJ
1,1,2,2-TETRACHLOROETHANE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	UJ
TOLUENE	ug/Kg	N/R		1.000	UJ	1.000	UJ	1.000	UJ	6.000	UJ
CHLOROBENZENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	UJ
ETHYLBENZENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	UJ
STYRENE	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	UJ
XYLENES (TOTAL)	ug/Kg	N/R		11.000	U	11.000	U	11.000	U	6.000	UJ
Semi-volatiles											
PHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
ANILINE		N/R		N/R		N/R		N/R		N/R	

Location 116-C-5

Parameter	Samp# Depth	B018X2 5.00		B018X3 10.00		B018X4 15.00		B018X5 20.00		B018X6 20.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
BIS(2-CHLOROETHYL)ETHER	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2-CHLOROPHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
1,3-DICHLOROBENZENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
1,4-DICHLOROBENZENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BENZYL ALCOHOL	ug/Kg	N/R		N/R		N/R		N/R		340.000	U
1,2-DICHLOROBENZENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2-METHYLPHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BIS(2-CHLOROISOPROPYL)ETHER	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
4-METHYLPHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
N-NITROSO-DI-N-PROPYLAMINE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
HEXACHLOROETHANE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
NITROBENZENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
ISOPHORONE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2-NITROPHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2,4-DIMETHYLPHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BENZOIC ACID	ug/Kg	N/R		N/R		N/R		N/R		1700.000	U
BIS(2-CHLOROETHOXY)METHANE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2,4-DICHLOROPHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
1,2,4-TRICHLOROBENZENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
NAPHTHALENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
4-CHLOROANILINE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
HEXACHLOROBUTADIENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
4-CHLORO-3-METHYLPHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2-METHYLNAPHTHALENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
HEXACHLOROCYCLOPENTADIENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2,4,6-TRICHLOROPHENOL	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2,4,5-TRICHLOROPHENOL	ug/Kg	860.000	U	890.000	U	880.000	U	860.000	U	1700.000	U
2-CHLORONAPHTHALENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2-NITROANILINE	ug/Kg	860.000	U	890.000	U	880.000	U	860.000	U	1700.000	U
DIMETHYLPHTHALATE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
ACENAPHTHYLENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2,6-DINITROTOLUENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
ANILINE		N/R		N/R		N/R		N/R		N/R	
3-NITROANILINE	ug/Kg	860.000	U	890.000	U	880.000	U	860.000	U	1700.000	U
ACENAPHTHENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2,4-DINITROPHENOL	ug/Kg	860.000	U	890.000	U	880.000	U	860.000	U	1700.000	U
4-NITROPHENOL	ug/Kg	860.000	U	890.000	U	880.000	U	860.000	U	1700.000	U
DIBENZOFURAN	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
2,4-DINITROTOLUENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U

9413207.1235

Location 116-C-5

Parameter	Samp# / Depth	B018X2 5.00		B018X3 10.00		B018X4 15.00		B018X5 20.00		B018X6 20.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
DIETHYLPHTHALATE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
4-CHLOROPHENYL-PHENYLETHER	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
FLUORENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
4-NITROANILINE	ug/Kg	860.000	U	890.000	U	880.000	U	860.000	U	1700.000	U
4,6-DINITRO-2-METHYLPHENOL	ug/Kg	860.000	U	890.000	U	880.000	U	860.000	U	1700.000	U
N-NITROSODIPHENYLAMINE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
4-BROMOPHENYL-PHENYLETHER	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
HEXACHLOROBENZENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
PENTACHLOROPHENOL	ug/Kg	860.000	U	890.000	U	880.000	U	860.000	U	1700.000	U
PHENANTHRENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
ANTHRACENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
CARBAZOLE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	N/R	
DI-N-BUTYLPHTHALATE	ug/Kg	56.000	U	60.000	U	53.000	U	360.000	U	340.000	U
FLUORANTHENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
PYRENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BUTYLBENZYLPHTHALATE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
3,3'-DICHLOROBENZIDINE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	680.000	U
BENZO(A)ANTHRACENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
CHRYSENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BIS(2-ETHYLHEXYL)PHTHALATE	ug/Kg	360.000	U	370.000	U	39.000	UJ	360.000	U	340.000	U
DI-N-OCTYLPHTHALATE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BENZO(B)FLUORANTHENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BENZO(K)FLUORANTHENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BENZO(A)PYRENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
INDENO(1,2,3-CD)PYRENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
DIBENZ(A,H)ANTHRACENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
BENZO(G,H,I)PERYLENE	ug/Kg	360.000	U	370.000	U	360.000	U	360.000	U	340.000	U
Pesticides											
ALPHA-BHC	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	8.600	U
BETA-BHC	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	8.600	U
DELTA-BHC	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	8.600	U
GAMMA-BHC (LINDANE)	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	8.600	U
HEPTACHLOR	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	8.600	U
ALDRIN	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	8.600	U
HEPTACHLOR EPOXIDE	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	8.600	U
ENDOSULFAN I	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	8.600	U
DIELDRIN	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	17.000	U
4,4'-DDE	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	17.000	U
ENDRIN	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	17.000	U

Location 116-C-5

Parameter	Samp# Depth	B018X2 5.00		B018X3 10.00		B018X4 15.00		B018X5 20.00		B018X6 20.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
ENDOSULFAN II	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	17.000	U
4,4'-DDD	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	17.000	U
ENDOSULFAN SULFATE	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	17.000	U
4,4'-DDT	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	17.000	U
METHOXYCHLOR	ug/Kg	19.000	U	19.000	U	18.000	U	19.000	U	86.000	U
ENDRIN KETONE	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	17.000	U
ENDRIN ALDEHYDE	ug/Kg	3.600	U	3.600	U	3.600	U	3.600	U	N/R	
ALPHA-CHLORDANE	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	86.000	U
GAMMA-CHLORDANE	ug/Kg	1.900	U	1.900	U	1.800	U	1.900	U	86.000	U
CHLORDANE		N/R		N/R		N/R		N/R		N/R	
TOXAPHENE	ug/Kg	190.000	U	190.000	U	180.000	U	190.000	U	170.000	U
AROCLOR-1016	ug/Kg	36.000	U	36.000	U	36.000	U	36.000	U	86.000	U
AROCLOR-1221	ug/Kg	74.000	U	74.000	U	72.000	U	73.000	U	86.000	U
AROCLOR-1232	ug/Kg	36.000	U	36.000	U	36.000	U	36.000	U	86.000	U
AROCLOR-1242	ug/Kg	36.000	U	36.000	U	36.000	U	36.000	U	86.000	U
AROCLOR-1248	ug/Kg	36.000	U	36.000	U	36.000	U	36.000	U	86.000	U
AROCLOR-1254	ug/Kg	36.000	U	36.000	U	36.000	U	36.000	U	170.000	U
AROCLOR-1260	ug/Kg	36.000	U	36.000	U	36.000	U	36.000	U	170.000	U

Location 116-B-1

Parameter	Samp# / Depth / Units	B05XY1 17.00 Result	Q	B05XY4 19.00 Result	Q	B05XY5 22.00 Result	Q	B05XY6 27.00 Result	Q
Inorganics									
ALUMINUM	MG/KG	7050.000		5330.000		6380.000		5530.000	
ANTIMONY	MG/KG	1.700	UJ	1.600	UJ	1.600	UJ	1.600	UJ
ARSENIC	MG/KG	2.200	U	1.700	U	2.100	U	1.700	U
BARIUM	MG/KG	104.000		64.400		79.900		55.100	
BERYLLIUM	MG/KG	0.210	U	0.200	U	0.200	U	0.320	U
CADMIUM	MG/KG	0.750	U	0.200	U	0.330	U	0.200	U
CALCIUM	MG/KG	4730.000		7850.000		3780.000		2790.000	
CHROMIUM	MG/KG	33.000		6.900		22.000		10.200	
COBALT	MG/KG	11.500		13.300		10.100		6.900	
COPPER	MG/KG	23.700		23.600		18.000		12.300	
IRON	MG/KG	21900.000		27300.000		19100.000		13000.000	
LEAD	MG/KG	5.800	J	5.200	J	5.600	J	4.000	J
MAGNESIUM	MG/KG	4210.000	J	4630.000	J	5540.000	J	3240.000	J
MANGANESE	MG/KG	298.000		839.000		262.000		213.000	
MERCURY	MG/KG	0.100	U	0.090	U	0.100	U	0.090	U
NICKEL	MG/KG	10.100	J	8.600	J	24.500	J	7.400	J
POTASSIUM	MG/KG	1010.000		907.000		771.000		896.000	
SELENIUM	MG/KG	0.840	UJ	0.780	UJ	0.820	UJ	0.810	UJ
SILVER	MG/KG	0.420	U	0.390	U	0.390	U	0.390	U
SODIUM	MG/KG	372.000		515.000		373.000		317.000	
THALLIUM	MG/KG	0.840	UJ	0.780	UJ	0.820	U	0.810	U
VANADIUM	MG/KG	56.400		54.400		45.300		31.100	
ZINC	MG/KG	128.000		51.000		53.900		33.600	
CYANIDE	MG/KG	0.530	U	0.490	U	0.530	U	0.510	U

Location 116-B-2

Parameter	Samp# Depth / Units	B05Y20 12.00 Result	Q	B05Y21 17.80 Result	Q	B05Y22 22.50 Result	Q	B05Y23 22.50 Result	Q
Inorganics									
ALUMINUM	MG/KG	7240.000		6910.000		7330.000		6680.000	
ANTIMONY	MG/KG	1.600	UJ	1.700	UJ	1.600	UJ	1.700	UJ
ARSENIC	MG/KG	2.600	U	2.500	U	2.400	U	2.000	U
BARIUM	MG/KG	82.200		71.700		92.600		76.600	
BERYLLIUM	MG/KG	0.200	U	0.210	U	0.200	U	0.210	U
CADMIUM	MG/KG	0.270	U	0.210	U	1.600	U	1.500	U
CALCIUM	MG/KG	4050.000		6180.000		6560.000		6010.000	
CHROMIUM	MG/KG	20.200		6.400		6.900		6.800	
COBALT	MG/KG	9.900		13.200		16.400		14.900	
COPPER	MG/KG	17.400		20.200		25.700		27.800	
IRON	MG/KG	20000.000		24600.000		30100.000		27800.000	
LEAD	MG/KG	4.900	J	2.900	UJ	3.300	UJ	3.100	UJ
MAGNESIUM	MG/KG	4440.000	J	4850.000	J	5210.000		5000.000	
MANGANESE	MG/KG	292.000		305.000		367.000		334.000	
MERCURY	MG/KG	0.090	U	0.100	U	0.090	UJ	0.090	UJ
NICKEL	MG/KG	9.000	J	9.500	J	9.300		9.400	
POTASSIUM	MG/KG	936.000		1020.000		1180.000		1030.000	
SELENIUM	MG/KG	0.840	UJ	0.800	UJ	4.100	UJ	4.000	UJ
SILVER	MG/KG	0.400	U	0.420	U	0.400	UJ	0.420	UJ
SODIUM	MG/KG	334.000		573.000		552.000		516.000	
THALLIUM	MG/KG	0.840	UJ	0.800	U	0.610	UJ	0.600	U
VANADIUM	MG/KG	44.300		52.700		76.900		65.800	
ZINC	MG/KG	60.000		45.500		59.300		58.400	
CYANIDE	MG/KG	0.530	U	0.530	U	0.510	U	0.500	U

Location 116-B-3

Parameter	Samp# / Depth	B05XY8 9.40		B05XZ0 12.70		B05XZ1 12.70		B05XZ3 16.80	
	Units	Result	Q	Result	Q	Result	Q	Result	Q
Inorganics									
ALUMINUM	MG/KG	6080.000		5890.000		4750.000		4430.000	
ANTIMONY	MG/KG	3.200	UJ	3.400	UJ	7.770	UJ	2.400	UJ
ARSENIC	MG/KG	2.000	U	2.800	U	1.100	U	1.200	U
BARIUM	MG/KG	133.000		65.800		56.600		59.600	
BERYLLIUM	MG/KG	0.200		0.230		0.540	U	0.220	U
CADMIUM	MG/KG	0.730	U	1.800		1.300	J	0.490	
CALCIUM	MG/KG	9280.000		5930.000		5670.000		6890.000	J
CHROMIUM	MG/KG	10.800	J	7.200	J	5.100		44.500	J
COBALT	MG/KG	11.800		13.500		13.000		10.200	
COPPER	MG/KG	16.400		17.600		14.000		17.400	
IRON	MG/KG	21300.000		23400.000		20200.000		23400.000	
LEAD	MG/KG	4.900	J	3.200	UJ	2.100	UJ	2.900	U
MAGNESIUM	MG/KG	4190.000		4980.000		4430.000		3950.000	
MANGANESE	MG/KG	301.000	J	367.000	J	330.000		290.000	J
MERCURY	MG/KG	0.100	U	0.100	U	0.050	U	0.100	U
NICKEL	MG/KG	8.000		9.600		7.900		8.500	
POTASSIUM	MG/KG	947.000		973.000		989.000		801.000	
SELENIUM	MG/KG	0.830	UJ	0.840	UJ	0.430	U	0.930	UJ
SILVER	MG/KG	0.400	UJ	0.420	UJ	3.000		0.650	U
SODIUM	MG/KG	458.000		287.000		262.000		287.000	
THALLIUM	MG/KG	0.830	U	0.840	U	0.430	U	0.930	U
VANADIUM	MG/KG	49.000	J	45.200	J	31.600		35.000	
ZINC	MG/KG	46.600		45.800		35.700		36.500	
CYANIDE	MG/KG	0.530	U	0.540	U	1.080	U	0.570	U

Location 116-B-5

Parameter	Samp# / Depth / Units	B05Y24 8.60 Result	Q	B05Y25 11.20 Result	Q	B05Y26 17.00 Result	Q
Inorganics							
ALUMINUM	MG/KG	5960.000		8170.000		4230.000	
ANTIMONY	MG/KG	2.100	UJ	2.300	UJ	2.200	UJ
ARSENIC	MG/KG	2.500	U	5.100	U	0.740	U
BARIUM	MG/KG	90.200		484.000		78.600	
BERYLLIUM	MG/KG	0.300		0.490		0.240	
CADMIUM	MG/KG	0.190	U	0.210	U	0.200	U
CALCIUM	MG/KG	6390.000		14500.000		5340.000	
CHROMIUM	MG/KG	12.600		19.600		6.900	
COBALT	MG/KG	9.200		9.400		12.100	
COPPER	MG/KG	17.200		26.800		26.100	
IRON	MG/KG	18500.000		17500.000		22500.000	
LEAD	MG/KG	3.800		7.000		2.500	U
MAGNESIUM	MG/KG	4640.000		4980.000		3820.000	
MANGANESE	MG/KG	315.000	J	301.000		291.000	
MERCURY	MG/KG	1.400		1.100	J	2.900	J
NICKEL	MG/KG	9.600		8.400		6.100	
POTASSIUM	MG/KG	899.000		872.000		533.000	
SELENIUM	MG/KG	0.770	UJ	4.000	R	4.100	R
SILVER	MG/KG	0.570	U	0.620	U	0.600	U
SODIUM	MG/KG	255.000	U	779.000		322.000	
THALLIUM	MG/KG	0.770	U	0.800	UJ	0.820	U
VANADIUM	MG/KG	39.300		39.800		43.700	
ZINC	MG/KG	68.400		69.400		125.000	
CYANIDE	MG/KG	0.520	U	0.530	U	0.510	U

Location 116-C-5

Parameter	Samp# / Depth	B018V1 0.00		B018V18 0.00		B018V4 0.00		B018V5 0.00		B018V6 0.00		B018V68 0.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Inorganics													
ALUMINUM	MG/KG	11000.000		2770.000	J	10700.000		10500.000		8760.000		5170.000	J
ANTIMONY	MG/KG	2.400	UJ	8.990	U	2.500	UJ	2.400	UJ	2.300	UJ	9.640	J
ARSENIC	MG/KG	5.200	U	2.000	U	3.700	U	4.700	U	3.100	U	2.100	U
BARIUM	MG/KG	91.400		90.600	J	96.000		88.000		83.700		67.700	J
BERYLLIUM	MG/KG	0.330		0.250		0.340		0.340		0.470		0.640	
CADMIUM	MG/KG	0.220	U	0.820	U	0.230	U	0.220	U	0.210	U	0.880	U
CALCIUM	MG/KG	6960.000		3350.000	J	6640.000		6190.000		4470.000		3480.000	J
CHROMIUM	MG/KG	18.900	J	7.400	J	226.000	J	270.000	J	336.000	J	137.000	J
COBALT	MG/KG	13.700		6.800	U	14.900		14.100		11.800		11.800	
COPPER	MG/KG	22.500		8.700		28.100		27.900		22.100		15.200	
IRON	MG/KG	28300.000		13700.000	J	40600.000		39200.000		42100.000		23000.000	J
LEAD	MG/KG	7.900		2.800	UJ	180.000		133.000		564.000	J	129.000	J
MAGNESIUM	MG/KG	6020.000		1900.000	J	6360.000		5790.000		4570.000		3030.000	J
MANGANESE	MG/KG	426.000	J	242.000	J	444.000	J	438.000	J	379.000	J	263.000	J
MERCURY	MG/KG	0.460	U	N/R		2.900		4.300		2.600		N/R	
NICKEL	MG/KG	13.400		4.900		18.900		18.200		15.800		7.400	
POTASSIUM	MG/KG	1690.000		475.000		1720.000		1600.000		1450.000		1050.000	
SELENIUM	MG/KG	4.300	UJ	0.410	UJ	0.900	UJ	0.870	UJ	0.810	UJ	0.440	UJ
SILVER	MG/KG	0.660	U	1.230	UJ	0.680	U	0.670	U	0.620	U	1.310	UJ
SODIUM	MG/KG	317.000		146.000		335.000		328.000		249.000		223.000	
THALLIUM	MG/KG	0.220	U	0.410	U	0.220	U	0.220	U	0.200	U	0.440	U
VANADIUM	MG/KG	63.300		16.400		61.300		56.300		47.100		26.600	
ZINC	MG/KG	60.000		23.100	J	125.000		138.000		131.000		77.900	J
CYANIDE	MG/KG	0.520	U	N/R		0.530	U	0.530	U	0.510	U	N/R	

Location 116-C-5

Parameter	Samp# / Depth / Units	B018V7 0.00 Result	Q	B018V7B 0.00 Result	Q	B018V8 0.00 Result	Q	B018V88 0.00 Result	Q	B018X1 1.50 Result	Q	B018X2 5.00 Result	Q
Inorganics													
ALUMINUM	MG/KG	9850.000		7230.000	J	10100.000		6220.000	J	8100.000		10400.000	
ANTIMONY	MG/KG	2.300	UJ	9.510	U	2.400	UJ	8.990	U	2.200	UJ	3.100	UJ
ARSENIC	MG/KG	4.800	U	3.300	U	4.000	U	3.300	U	3.600	U	3.200	U
BARIUM	MG/KG	94.800		75.500	J	97.000		66.700	J	81.800		260.000	
BERYLLIUM	MG/KG	0.230		0.410		0.330		0.390		0.320	U	0.340	U
CADMIUM	MG/KG	0.210	U	0.870	U	0.220	U	0.820	U	0.200	U	0.210	U
CALCIUM	MG/KG	5630.000		4780.000	J	5630.000		3890.000	J	3920.000		5910.000	
CHROMIUM	MG/KG	609.000	J	453.000	J	335.000	J	226.000	J	12.000		15.100	
COBALT	MG/KG	13.200		11.900		13.500		10.400		8.900		8.600	
COPPER	MG/KG	46.800		35.200		30.900		18.200		15.200		16.600	
IRON	MG/KG	44600.000		39600.000	J	42800.000		28300.000	J	17100.000		18000.000	
LEAD	MG/KG	353.000		106.000	J	108.000		82.100	J	8.000		12.600	
MAGNESIUM	MG/KG	5300.000		4040.000	J	5660.000		3520.000	J	4660.000		4460.000	
MANGANESE	MG/KG	445.000	J	365.000	J	520.000	J	321.000	J	334.000		334.000	
MERCURY	MG/KG	3.400		N/R		2.000		N/R		0.090	U	0.150	U
NICKEL	MG/KG	24.300		21.800		19.300		11.000		12.900		11.500	
POTASSIUM	MG/KG	1390.000		1000.000		1550.000		1080.000		1700.000		1560.000	
SELENIUM	MG/KG	0.820	UJ	0.430	UJ	0.820	UJ	0.410	UJ	0.590	UJ	0.430	U
SILVER	MG/KG	0.620	U	1.300	UJ	0.660	U	1.230	UJ	0.890		1.300	
SODIUM	MG/KG	286.000		222.000		289.000		199.000		143.000		344.000	
THALLIUM	MG/KG	0.220	U	0.430	U	0.210	U	0.410	U	0.820	U	0.920	U
VANADIUM	MG/KG	56.900		35.700		59.700		31.400		34.100		36.000	
ZINC	MG/KG	309.000		259.000	J	161.000		133.000	J	45.200		53.900	
CYANIDE	MG/KG	0.550	U	N/R		0.550	U	N/R		0.510	U	0.550	U

Location 116-C-5

Parameter	Samp# / Depth	B018X3 10.00		B018X4 15.00		B018X5 20.00		B018X6 20.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q
Inorganics									
ALUMINUM	MG/KG	10500.000		11300.000		12500.000		8450.000	J
ANTIMONY	MG/KG	2.400	UJ	2.600	UJ	2.900	UJ	9.240	UJ
ARSENIC	MG/KG	3.400	U	3.200	U	4.000	U	1.400	UJ
BARIUM	MG/KG	97.600		104.000		107.000		113.000	J
BERYLLIUM	MG/KG	0.270	U	0.370	U	0.400	U	0.420	
CADMIUM	MG/KG	0.220	U	0.220	U	0.240	U	0.840	
CALCIUM	MG/KG	4910.000		4530.000		4910.000		4960.000	J
CHROMIUM	MG/KG	11.800		14.200		16.600		8.400	
COBALT	MG/KG	12.200		12.900		13.900		12.900	
COPPER	MG/KG	20.600		20.600		22.900		21.700	J
IRON	MG/KG	22600.000		24000.000		25600.000		18300.000	J
LEAD	MG/KG	6.800		6.400		7.000		4.700	J
MAGNESIUM	MG/KG	5750.000		5900.000		6390.000		4830.000	J
MANGANESE	MG/KG	392.000		403.000		435.000		446.000	J
MERCURY	MG/KG	0.100	U	0.090	U	0.120	U	0.140	U
NICKEL	MG/KG	13.000		15.400		16.100		13.900	
POTASSIUM	MG/KG	1810.000		2040.000		2130.000		1990.000	
SELENIUM	MG/KG	0.430	U	0.460	UJ	0.480	U	0.420	UJ
SILVER	MG/KG	1.700		1.900		1.900		1.700	
SODIUM	MG/KG	277.000		280.000		400.000		359.000	
THALLIUM	MG/KG	0.920	U	0.950	U	1.000	U	0.420	U
VANADIUM	MG/KG	41.600		44.500		48.900		25.000	
ZINC	MG/KG	55.600		57.700		61.400		46.500	J
CYANIDE	MG/KG	0.560	U	0.550	U	0.600	U	1.050	

Location 116-B-1

Parameter	Samp# Depth	B05XY1 17.00		B05XY4 19.00		B05XY5 22.00		B05XY6 27.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q
Radionuclides									
AMERICIUM-241	pCi/g	0.482	R	0.130	R	0.050		0.002	
BARIUM-140		N/R		N/R		N/R		N/R	
BERYLLIUM-7		N/R		N/R		N/R		N/R	
CARBON-14	pCi/g	3.770	J	6.180	J	3.760	J	1.890	J
CERIUM-141		N/R		N/R		N/R		N/R	
CERIUM-144		N/R		N/R		N/R		N/R	
COBALT-58		N/R		N/R		N/R		N/R	
COBALT-60	pCi/g	4.167		1.589	J	0.389		0.158	U
CHROMIUM-51	pCi/g	35.010	U	27.960	UJ	14.250	U	7.833	U
CESIUM-134	pCi/g	0.686	U	0.453	UJ	0.222	U	0.177	U
CESIUM-137	pCi/g	43.850		22.990	J	10.360		1.394	
EUROPIUM-152	pCi/g	121.900		59.150	J	17.560		4.114	
EUROPIUM-154	pCi/g	9.900		4.749	J	1.195		N/R	
EUROPIUM-155		N/R		N/R		N/R		N/R	
IRON-59		N/R		N/R		N/R		N/R	
GROSS ALPHA SCAN	pCi/g	-1.490		8.890	R	5.180	R	1.900	R
GROSS BETA SCAN	pCi/g	201.000		76.700	R	54.300		14.900	U
TRITIUM		N/R		N/R		N/R		N/R	
IODINE-131		N/R		N/R		N/R		N/R	
POTASSIUM-40	pCi/g	15.590	U	13.720	UJ	10.190	U	10.180	U
MANGANESE-54		N/R		N/R		N/R		N/R	
PLUTONIUM-238	pCi/g	0.108	R	0.088	R	-0.164	U	-0.035	U
PLUTONIUM-239	pCi/g	3.600	R	0.920	R	0.269		0.067	U
PLUTONIUM-239/240		N/R		N/R		N/R		N/R	
RADIUM-226	pCi/g	1.043	U	0.802	UJ	0.495	U	0.322	U
RUTHENIUM-103		N/R		N/R		N/R		N/R	
RUTHENIUM-106		N/R		N/R		N/R		N/R	
STRONTIUM-90	pCi/g	13.200		6.380		5.080		1.540	
TECHNETIUM-99		N/R		N/R		N/R		N/R	
THORIUM-228	pCi/g	0.869	U	0.699	UJ	0.478	U	0.608	U
THORIUM-232	pCi/g	2.028	U	2.135	UJ	0.878	U	0.746	U
THORIUM-234		N/R		N/R		N/R		N/R	
URANIUM-233/234	pCi/g	0.436	UR	0.440	UR	0.565	UR	0.396	U
URANIUM-234		N/R		N/R		N/R		N/R	
URANIUM-235	pCi/g	0.047	UR	0.000	UR	0.057	UR	0.006	U
URANIUM-238	pCi/g	0.461	UR	0.493	UR	0.424	UR	0.327	U
ZINC-65	pCi/g	3.127	U	1.935	UJ	0.951	U	0.656	U
ZIRCONIUM-95		N/R		N/R		N/R		N/R	

Location 116-B-2

Parameter	Samp# / Depth	805Y20 12.00		805Y21 17.80		805Y22 22.50	
	Units	Result	Q	Result	Q	Result	Q
Radionuclides							
AMERICIUM-241	pCi/g	0.023	R	0.366		-0.019	J
BARIUM-140		N/R		N/R		N/R	
BERYLLIUM-7		N/R		N/R		N/R	
CARBON-14	pCi/g	3.030	J	3.950	J	-1.030	UJ
CERIUM-141		N/R		N/R		N/R	
CERIUM-144		N/R		N/R		N/R	
COBALT-58		N/R		N/R		N/R	
COBALT-60	pCi/g	0.135		0.111	U	0.108	U
CHROMIUM-51	pCi/g	26.350	U	5.403	U	5.197	U
CESIUM-134	pCi/g	0.206	U	0.106	U	0.103	U
CESIUM-137	pCi/g	91.320		0.092	U	0.110	U
EUROPIUM-152	pCi/g	10.360		N/R		N/R	
EUROPIUM-154	pCi/g	0.564		N/R		N/R	
EUROPIUM-155		N/R		N/R		N/R	
IRON-59		N/R		N/R		N/R	
GROSS ALPHA SCAN	pCi/g	2.260	R	2.930	R	-2.550	R
GROSS BETA SCAN	pCi/g	123.000		8.510	U	7.320	UJ
TRITIUM		N/R		N/R		N/R	
IODINE-131		N/R		N/R		N/R	
POTASSIUM-40	pCi/g	6.785	U	8.500	U	6.822	U
MANGANESE-54		N/R		N/R		N/R	
PLUTONIUM-238	pCi/g	0.033	R	0.000	U	0.053	J
PLUTONIUM-239	pCi/g	5.710	R	0.050	U	-0.021	UJ
PLUTONIUM-239/240		N/R		N/R		N/R	
RADIUM-226	pCi/g	0.540	U	0.423	U	0.326	U
RUTHENIUM-103		N/R		N/R		N/R	
RUTHENIUM-106		N/R		N/R		N/R	
STRONTIUM-90	pCi/g	64.100		0.988		0.400	J
TECHNETIUM-99		N/R		N/R		N/R	
THORIUM-228	pCi/g	0.595	U	0.615	U	0.535	U
THORIUM-232	pCi/g	0.761	U	0.637	U	0.678	U
THORIUM-234		N/R		N/R		N/R	
URANIUM-233/234	pCi/g	0.593	UR	0.663	U	0.499	UJ
URANIUM-234		N/R		N/R		N/R	
URANIUM-235	pCi/g	0.000	UR	0.018	U	0.022	UR
URANIUM-238	pCi/g	0.480	UR	0.564	U	0.507	UJ
ZINC-65	pCi/g	0.931	U	0.237	U	0.292	U
ZIRCONIUM-95		N/R		N/R		N/R	

Location 115-B-3

Parameter	Samp# / Depth / Units	B05XY8 9.40 Result	Q	B05XZ0 12.70 Result	Q	B05XZ1 12.70 Result	Q	B05XZ3 16.80 Result	Q
Radionuclides									
AMERICIUM-241	pCi/g	0.083		0.024		0.008	UR	0.020	
BARIUM-140	pCi/g	N/R		N/R		30.000	UR	N/R	
BERYLLIUM-7	pCi/g	N/R		N/R		2.000	UR	N/R	
CARBON-14	pCi/g	4.100	UJ	3.580	J	0.600	UR	1.100	UJ
CERIUM-141	pCi/g	N/R		N/R		0.700	UR	N/R	
CERIUM-144	pCi/g	N/R		N/R		0.300	UR	N/R	
COBALT-58	pCi/g	N/R		N/R		0.100	UR	N/R	
COBALT-60	pCi/g	0.085	U	0.097	UJ	0.040	UR	0.084	UJ
CHROMIUM-51	pCi/g	17.840	U	5.782	UJ	N/R		2.979	UJ
CESIUM-134	pCi/g	0.102	U	0.140	UJ	0.060	UR	0.096	UJ
CESIUM-137	pCi/g	78.580		4.705	J	2.780	R	0.253	J
EUROPIUM-152	pCi/g	N/R		N/R		0.100	UR	N/R	
EUROPIUM-154	pCi/g	N/R		N/R		0.100	UR	N/R	
EUROPIUM-155	pCi/g	N/R		N/R		0.200	UR	N/R	
IRON-59	pCi/g	N/R		N/R		0.500	UR	N/R	
GROSS ALPHA SCAN	pCi/g	-3.390	R	2.760	R	5.000	R	-2.180	R
GROSS BETA SCAN	pCi/g	207.000	R	26.300	UR	54.000	R	7.540	UR
TRITIUM		N/R		N/R		N/R		N/R	
IODINE-131	pCi/g	N/R		N/R		1000.000	UR	N/R	
POTASSIUM-40	pCi/g	9.181	U	8.063	UJ	15.300	UR	7.914	UJ
MANGANESE-54	pCi/g	N/R		N/R		0.050	UR	N/R	
PLUTONIUM-238	pCi/g	0.035	J	-0.005	U	N/R		-0.018	UJ
PLUTONIUM-239	pCi/g	0.791	J	0.075	U	0.039	UR	0.006	U
PLUTONIUM-239/240		N/R		N/R		N/R		N/R	
RADIUM-226	pCi/g	0.720	U	0.313	UJ	0.900	UR	0.271	UJ
RUTHENIUM-103	pCi/g	N/R		N/R		0.400	UR	N/R	
RUTHENIUM-106	pCi/g	N/R		N/R		0.500	UR	N/R	
STRONTIUM-90	pCi/g	39.200	J	5.570	UJ	4.900	R	0.587	J
TECHNETIUM-99		N/R		N/R		N/R		N/R	
THORIUM-228	pCi/g	0.713	U	0.579	UJ	0.723	R	0.594	UJ
THORIUM-232	pCi/g	0.419	U	0.892	UJ	N/R		0.450	UJ
THORIUM-234	pCi/g	N/R		N/R		0.900	UR	N/R	
URANIUM-233/234	pCi/g	0.206	U	0.476	U	N/R		0.530	UR
URANIUM-234		N/R		N/R		N/R		N/R	
URANIUM-235	pCi/g	0.013	UR	0.000	UR	0.007	UR	0.008	UR
URANIUM-238	pCi/g	0.188	U	0.439	U	0.240	UR	0.536	UR
ZINC-65	pCi/g	0.237	U	0.292	UJ	0.100	UR	0.249	UJ
ZIRCONIUM-95	pCi/g	N/R		N/R		0.200	UR	N/R	

Location 116-B-5

Parameter	Samp# Depth	B05Y24 8.60		B05Y25 11.20		B05Y26 17.00	
	Units	Result	Q	Result	Q	Result	Q
Radionuclides							
AMERICIUM-241	pCi/g	0.006		0.002		0.002	
BARIUM-140		N/R		N/R		N/R	
BERYLLIUM-7		N/R		N/R		N/R	
CARBON-14	pCi/g	3.360	UJ	3.770	UJ	2.010	UJ
CERIUM-141		N/R		N/R		N/R	
CERIUM-144		N/R		N/R		N/R	
COBALT-58		N/R		N/R		N/R	
COBALT-60	pCi/g	0.134	J	0.260	J	0.184	J
CHROMIUM-51	pCi/g	3.204	UJ	3.140	UJ	2.902	UJ
CESIUM-134	pCi/g	0.119	UJ	0.128	UJ	0.113	UJ
CESIUM-137	pCi/g	0.132	J	0.202	UJ	0.104	UJ
EUROPIUM-152	pCi/g	1.166	J	1.527	J	N/R	
EUROPIUM-154		N/R		N/R		N/R	
EUROPIUM-155		N/R		N/R		N/R	
IRON-59		N/R		N/R		N/R	
GROSS ALPHA SCAN	pCi/g	3.060	R	3.610	R	6.790	R
GROSS BETA SCAN	pCi/g	3.240	UR	6.450	UR	13.600	UR
TRITIUM		N/R		N/R		N/R	
IODINE-131		N/R		N/R		N/R	
POTASSIUM-40	pCi/g	10.830	UJ	8.672	UJ	8.709	UJ
MANGANESE-54		N/R		N/R		N/R	
PLUTONIUM-238	pCi/g	-0.018	UJ	-0.193	UJ	0.004	UJ
PLUTONIUM-239	pCi/g	0.018	U	-0.125	U	0.016	U
PLUTONIUM-239/240		N/R		N/R		N/R	
RADIUM-226	pCi/g	0.354	UJ	0.449	UJ	0.227	UJ
RUTHENIUM-103		N/R		N/R		N/R	
RUTHENIUM-106		N/R		N/R		N/R	
STRONTIUM-90	pCi/g	0.000	J	-0.107	J	-0.150	J
TECHNETIUM-99		N/R		N/R		N/R	
THORIUM-228	pCi/g	0.606	UJ	0.562	UJ	0.486	UJ
THORIUM-232	pCi/g	0.748	UJ	0.505	UJ	0.529	UJ
THORIUM-234		N/R		N/R		N/R	
URANIUM-233/234	pCi/g	0.573	UR	0.917	UJ	0.568	UR
URANIUM-234		N/R		N/R		N/R	
URANIUM-235	pCi/g	0.029	UR	0.054	UR	0.026	UR
URANIUM-238	pCi/g	0.521	UR	0.842	UJ	0.636	UR
ZINC-65	pCi/g	1.310	UJ	0.409	UJ	0.296	UJ
ZIRCONIUM-95		N/R		N/R		N/R	

Location 116-C-5

Parameter	Samp# Depth	B018V1 0.00		B018V4 0.00		B018V5 0.00		B018V6 0.00		B018V7 0.00		B018V8 0.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Radionuclides													
AMERICIUM-241	pCi/g	0.850	R	13.000	R	7.500	R	7.700	R	29.000	R	34.000	
BARIUM-140		N/R		N/R		N/R		N/R		N/R		N/R	
BERYLLIUM-7		N/R		N/R		N/R		N/R		N/R		N/R	
CARBON-14	pCi/g	6.800	U	26.000	BJ	16.000	BJ	49.000	BJ	640.000	B	130.000	B
CERIUM-141		N/R		N/R		N/R		N/R		N/R		N/R	
CERIUM-144		N/R		N/R		N/R		N/R		N/R		N/R	
COBALT-58		N/R		N/R		N/R		N/R		N/R		N/R	
COBALT-60	pCi/g	10.000		180.000		160.000		130.000		310.000		300.000	
CHROMIUM-51	pCi/g	14.000	U	55.000	U	56.000	U	49.000	U	60.000	U	73.000	U
CESIUM-134	pCi/g	0.670	U	2.100	U	2.500	U	2.200	U	2.800	U	3.200	U
CESIUM-137	pCi/g	5.100		790.000		720.000		200.000		800.000		450.000	
EUROPIUM-152	pCi/g	81.000		1400.000		1300.000		820.000		1100.000		1400.000	
EUROPIUM-154	pCi/g	20.000		250.000		240.000		150.000		380.000		410.000	
EUROPIUM-155	pCi/g	1.900	J	18.000		11.000		11.000		31.000		41.000	
IRON-59		N/R		N/R		N/R		N/R		N/R		N/R	
GROSS ALPHA SCAN	pCi/g	-13.000	UR	22.000	R	14.000	UR	52.000	R	110.000	R	75.000	R
GROSS BETA SCAN	pCi/g	83.000	J	2400.000		1900.000		1300.000	J	2700.000		3700.000	
TRITIUM		N/R		N/R		N/R		N/R		N/R		N/R	
IODINE-131		N/R		N/R		N/R		N/R		N/R		N/R	
POTASSIUM-40	pCi/g	13.000	U	8.300	U	9.900	U	8.800	U	10.000	U	12.000	U
MANGANESE-54		N/R		N/R		N/R		N/R		N/R		N/R	
PLUTONIUM-238	pCi/g	0.041	R	1.200	R	0.930	R	0.850	R	1.800	R	9.400	R
PLUTONIUM-239		N/R		N/R		N/R		N/R		N/R		N/R	
PLUTONIUM-239/240	pCi/g	0.860	R	36.000	R	22.000	R	22.000	R	52.000	R	190.000	R
RADIUM-226	pCi/g	0.840		3.200	U	3.700	U	2.900	U	4.000	U	4.600	U
RUTHENIUM-103		N/R		N/R		N/R		N/R		N/R		N/R	
RUTHENIUM-106		N/R		N/R		N/R		N/R		N/R		N/R	
STRONTIUM-90	pCi/g	7.800	J	180.000		94.000		110.000		770.000		540.000	
TECHNETIUM-99		N/R		N/R		N/R		N/R		N/R		N/R	
THORIUM-228	pCi/g	0.760	U	2.800	U	3.000	U	2.500	U	3.200	U	3.700	U
THORIUM-232	pCi/g	2.500	U	7.300	U	8.700	U	8.300	U	10.000	U	11.000	U
THORIUM-234		N/R		N/R		N/R		N/R		N/R		N/R	
URANIUM-233/234	pCi/g	0.670	UR	1.400	R	0.890	UR	0.690	UR	1.200	R	1.100	UR
URANIUM-234		N/R		N/R		N/R		N/R		N/R		N/R	
URANIUM-235	pCi/g	0.031	UR	0.070	UR	0.042	UR	0.023	UR	0.081	R	0.033	UR
URANIUM-238	pCi/g	0.700	UR	1.300	R	0.840	UR	0.720	UR	1.100	UR	0.880	UR
ZINC-65	pCi/g	3.000	U	7.500	U	9.600	U	8.000	U	9.700	U	11.000	U
ZIRCONIUM-95		N/R		N/R		N/R		N/R		N/R		N/R	

Location 116-C-5

Parameter	Samp# Depth	B018X1 1.50		B018X2 5.00		B018X3 10.00		B018X4 15.00		B018X5 20.00		B018X6 20.00	
	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Radionuclides													
AMERICIUM-241	pCi/g	0.011	U	0.130		-0.002	U	0.007	U	0.005	U	0.004	R
BARIUM-140		N/R		N/R		N/R		N/R		N/R		N/R	
BERYLLIUM-7		N/R		N/R		N/R		N/R		N/R		N/R	
CARBON-14	pCi/g	-4.700	UJ	7.700	UJ	-1.300	UJ	0.500	UJ	-7.900	UJ	0.410	R
CERIUM-141		N/R		N/R		N/R		N/R		N/R		N/R	
CERIUM-144		N/R		N/R		N/R		N/R		N/R		N/R	
COBALT-58		N/R		N/R		N/R		N/R		N/R		N/R	
COBALT-60	pCi/g	N/R		3.200		N/R		N/R		N/R		N/R	
CHROMIUM-51	pCi/g	N/R		N/R		N/R		N/R		N/R		N/R	
CESIUM-134	pCi/g	N/R		N/R		N/R		N/R		N/R		N/R	
CESIUM-137	pCi/g	0.085		9.800		0.091		N/R		N/R		N/R	
EUROPIUM-152	pCi/g	N/R		13.000		0.078		N/R		N/R		N/R	
EUROPIUM-154	pCi/g	N/R		2.000		N/R		N/R		N/R		N/R	
EUROPIUM-155	pCi/g	N/R		N/R		N/R		N/R		N/R		N/R	
IRON-59		N/R		N/R		N/R		N/R		N/R		N/R	
GROSS ALPHA SCAN	pCi/g	7.200	R	10.000	R	3.900	R	5.700	R	3.900	R	15.000	R
GROSS BETA SCAN	pCi/g	18.000		32.000		16.000		16.000		17.000		36.000	R
TRITIUM		N/R		N/R		N/R		N/R		N/R		N/R	
IODINE-131		N/R		N/R		N/R		N/R		N/R		N/R	
POTASSIUM-40	pCi/g	13.000	U	11.000	U	10.000	U	8.900	U	7.900	U	9.780	UR
MANGANESE-54		N/R		N/R		N/R		N/R		N/R		N/R	
PLUTONIUM-238	pCi/g	-0.006	UJ	-0.030	UJ	0.004	UJ	0.000	UJ	0.000	UJ	N/R	
PLUTONIUM-239		N/R		N/R		N/R		N/R		N/R		N/R	
PLUTONIUM-239/240	pCi/g	0.006	UJ	0.210	J	0.004	UJ	0.003	UJ	0.008	UJ	0.001	R
RADIUM-226	pCi/g	0.520	U	0.680		0.330	U	0.430	U	0.320	U	1.020	R
RUTHENIUM-103		N/R		N/R		N/R		N/R		N/R		N/R	
RUTHENIUM-106		N/R		N/R		N/R		N/R		N/R		N/R	
STRONTIUM-90	pCi/g	0.250	U	1.300	J	0.110	U	-0.004	U	0.180	U	0.012	R
TECHNETIUM-99		N/R		N/R		N/R		N/R		N/R		N/R	
THORIUM-228	pCi/g	0.820	U	0.910	U	N/R		0.700	U	0.610	U	4.400	R
THORIUM-232	pCi/g	0.880	U	0.740	U	0.600	U	0.520	U	0.430	U	N/R	
THORIUM-234		N/R		N/R		N/R		N/R		N/R		N/R	
URANIUM-233/234	pCi/g	0.720	U	1.100	U	0.910	U	0.780		0.840		N/R	
URANIUM-234		N/R		N/R		N/R		N/R		N/R		N/R	
URANIUM-235	pCi/g	-0.023	U	-0.016	UJ	0.069	UJ	0.095	UJ	0.000	UJ	0.009	R
URANIUM-238	pCi/g	0.660	UJ	0.920	UJ	0.810	UJ	0.850	UJ	0.580	UJ	0.390	UR
ZINC-65	pCi/g	N/R		N/R		N/R		N/R		N/R		N/R	
ZIRCONIUM-95		N/R		N/R		N/R		N/R		N/R		N/R	

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APPENDIX B

SPECTRAL GAMMA-RAY GEOPHYSICAL LOGS

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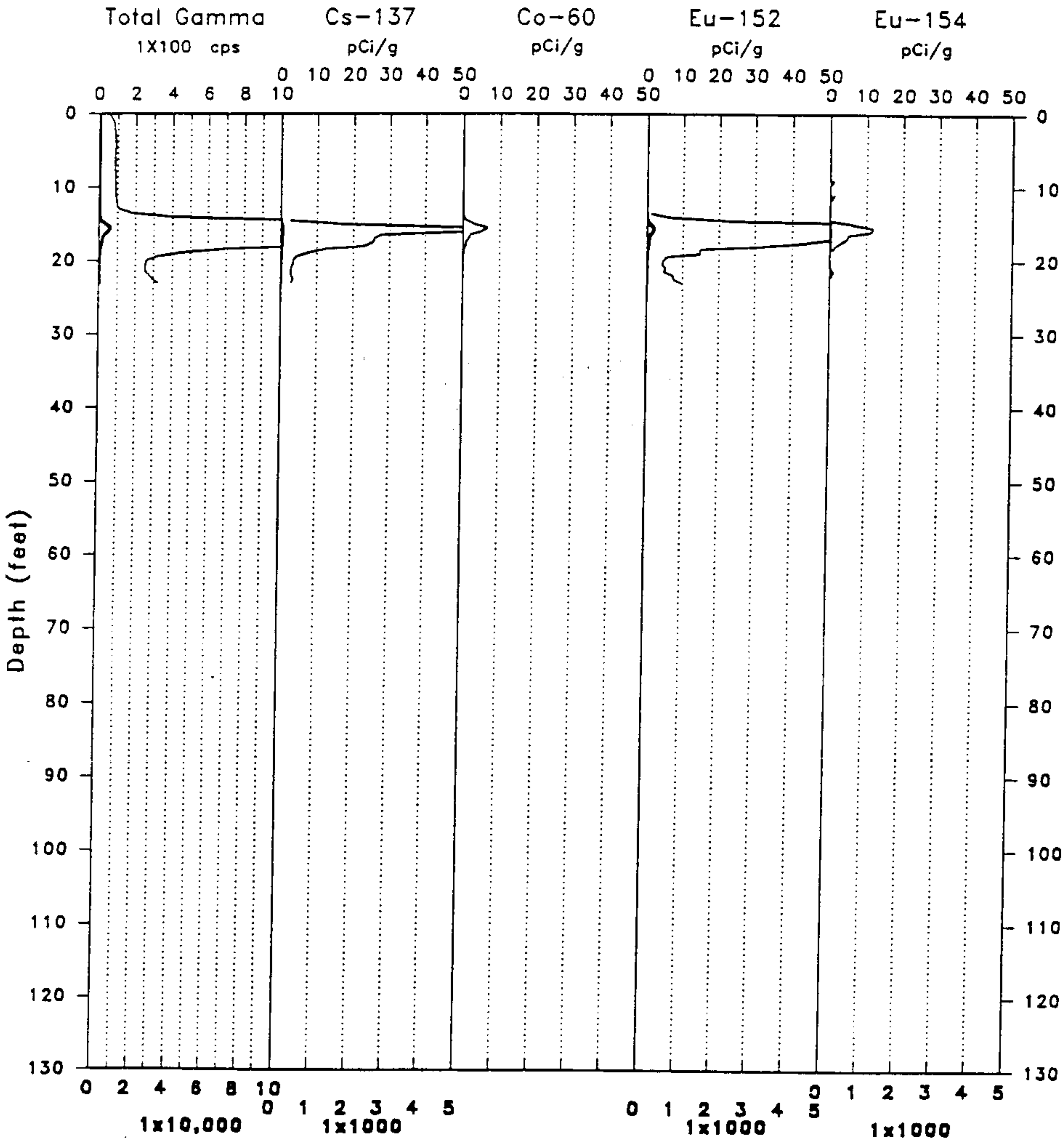
RLS Spectral Gamma-Ray Borehole Survey

Project: 100-BC-1 | Log Date: Mar 25, 1992

Borehole: 116-B-1 | Anal. Date: Apr 09, 1992



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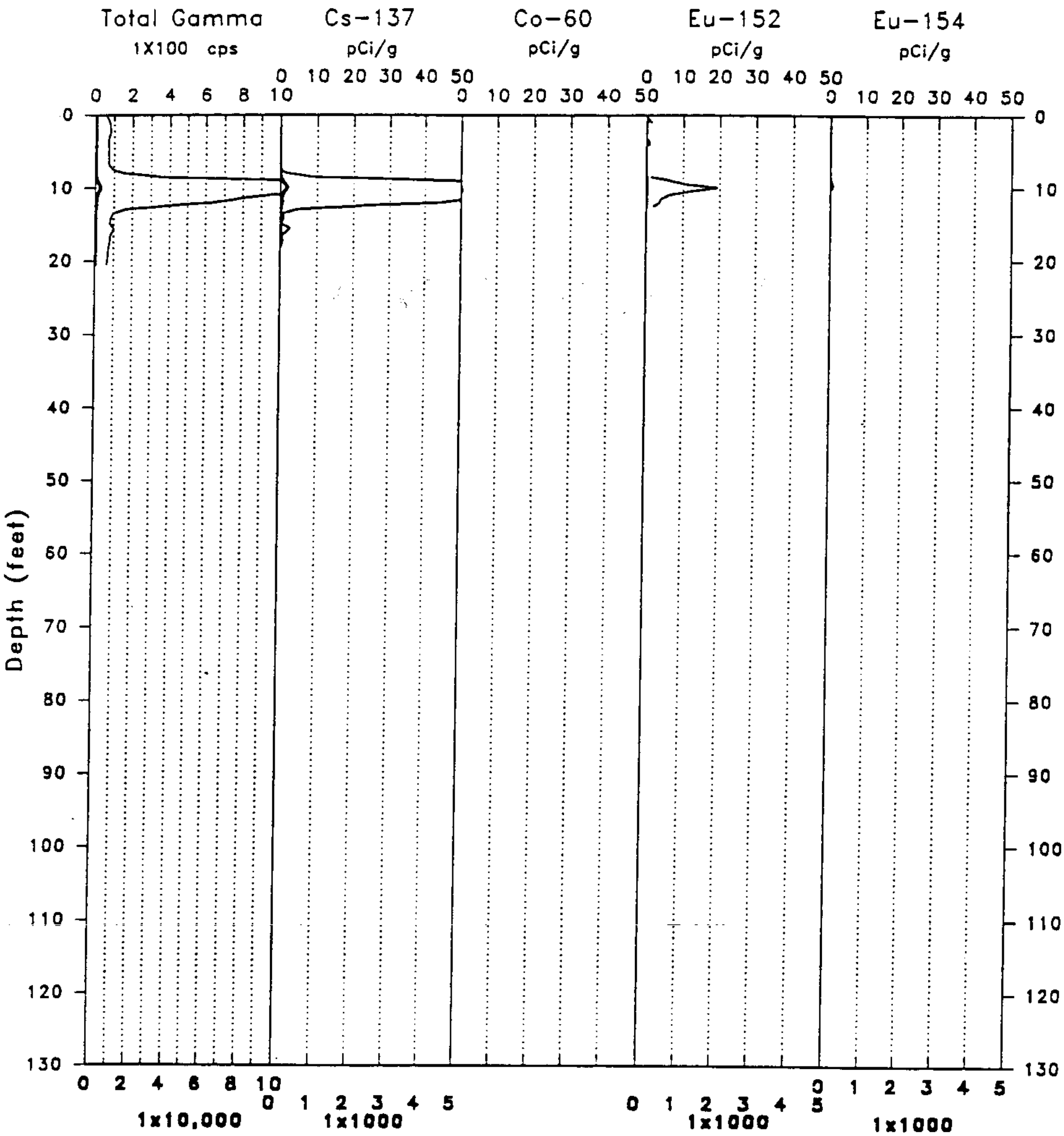
RLS Spectral Gamma-Ray Borehole Survey

Project: 100-BC-1
Borehole: 116-B-2

Log Date: Mar 17, 1992
Anal. Date: Apr 09, 1992



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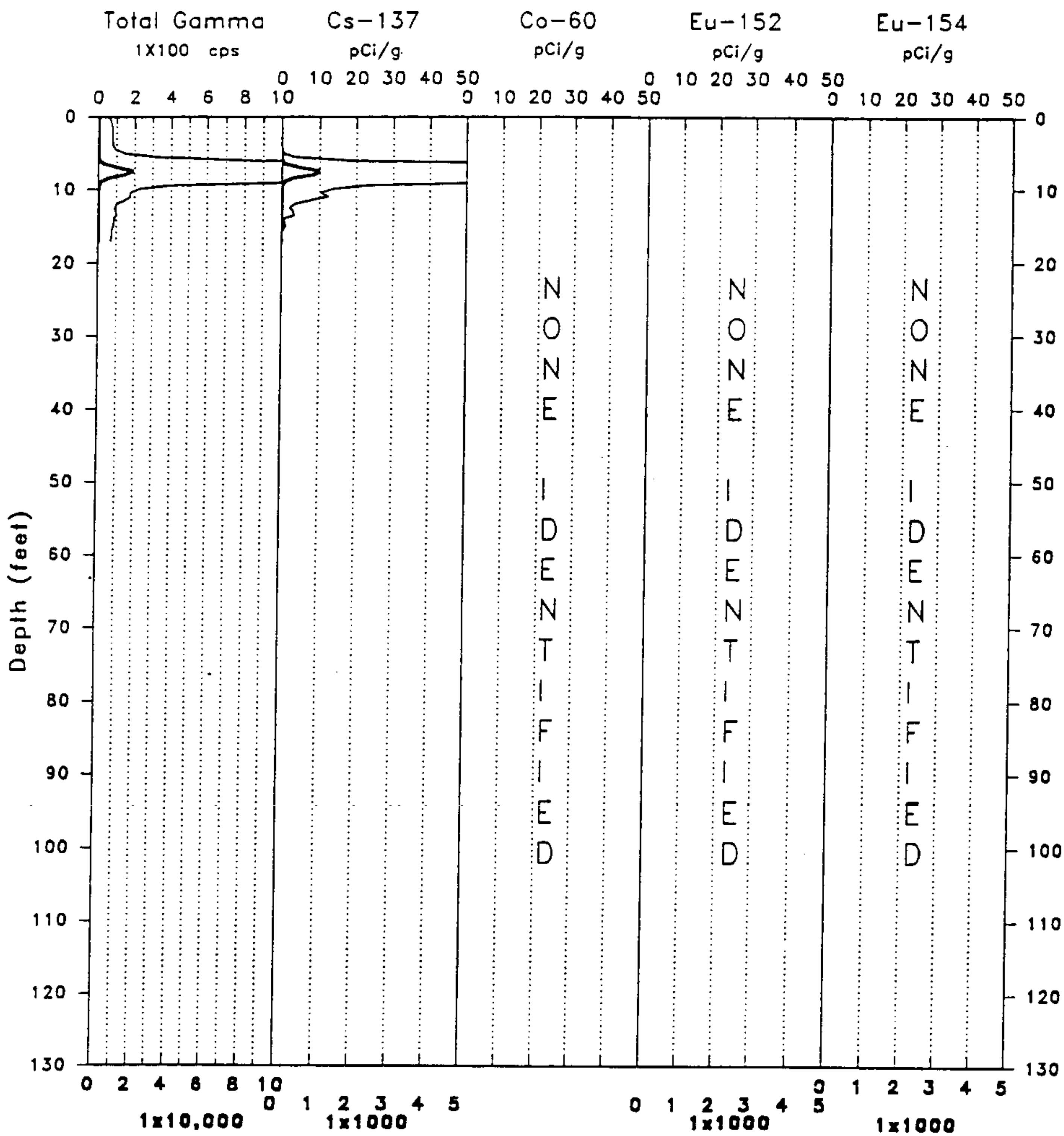
RLS Spectral Gamma-Ray Borehole Survey

Project: 100-BC-1
Log Date: Apr 08, 1992
Borehole: 116-B-3
Anal. Date: Aug 13, 1992



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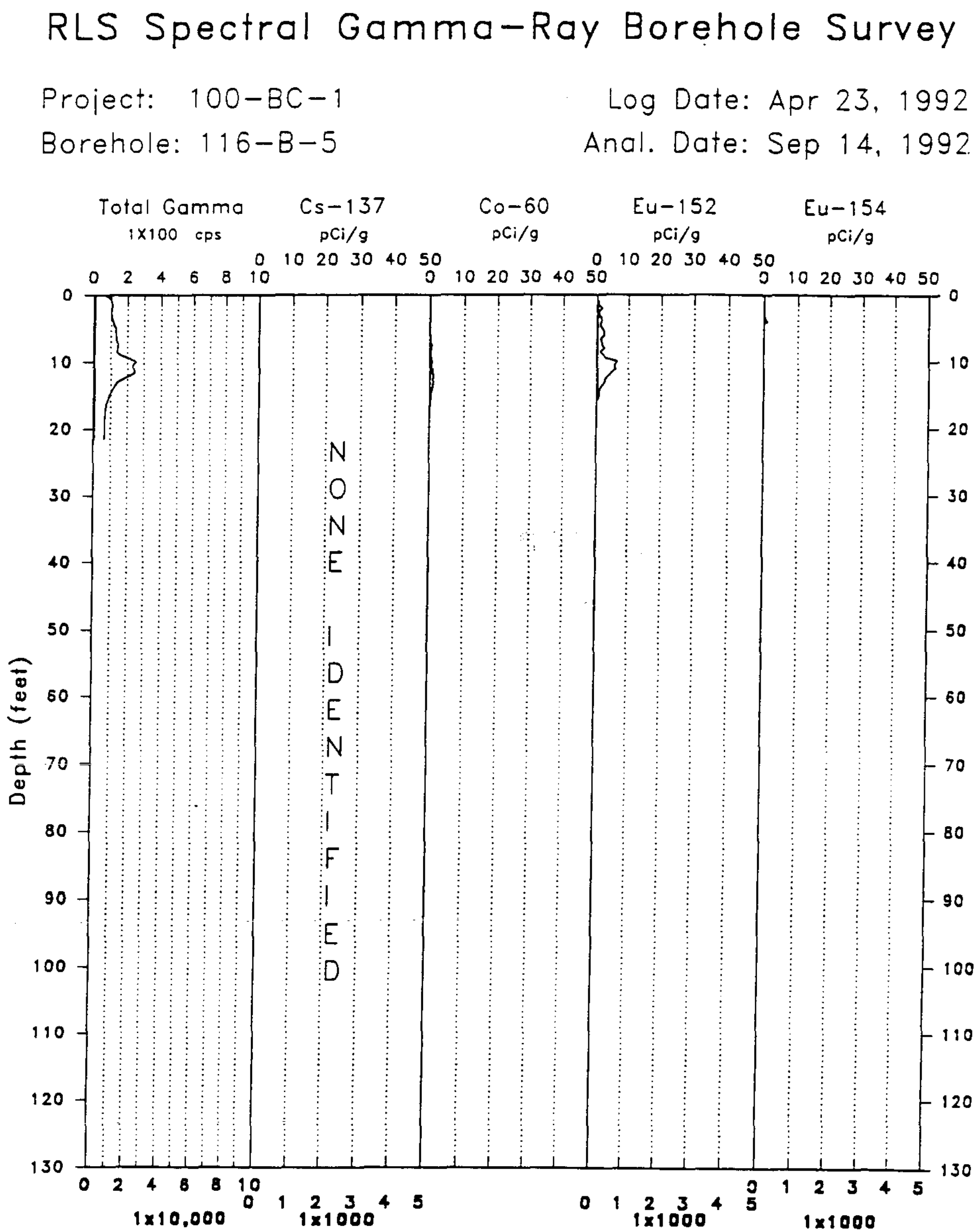
RLS Spectral Gamma-Ray Borehole Survey
Project: 100-BC-1
Log Date: Apr 23, 1992
Borehole: 116-B-5
Anal. Date: Sep 14, 1992
Total Gamma
1X100 cps
Cs-137
pCi/g
Co-60
pCi/g
Eu-152
pCi/g
Eu-154
pCi/g
NONE IDENTIFIED
Depth (feet)
1x10,000
1x1000
1x1000
1x1000

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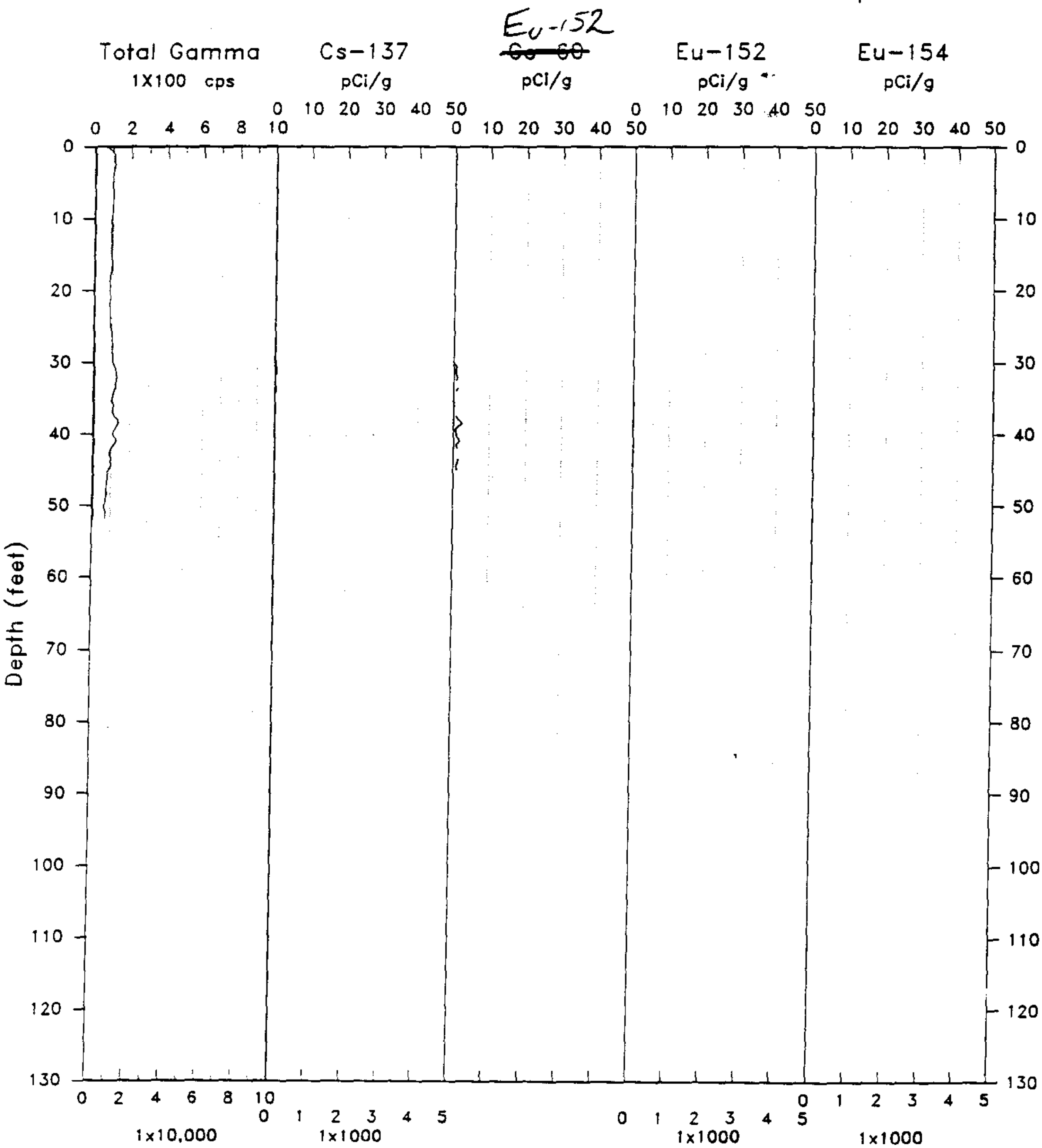
RLS Spectral Gamma-Ray Borehole Survey

Project: 100-BC-5 Log Date: Jun 30, 92

Borehole: 199-B3-1 Anal. Date: Sep 10, 92



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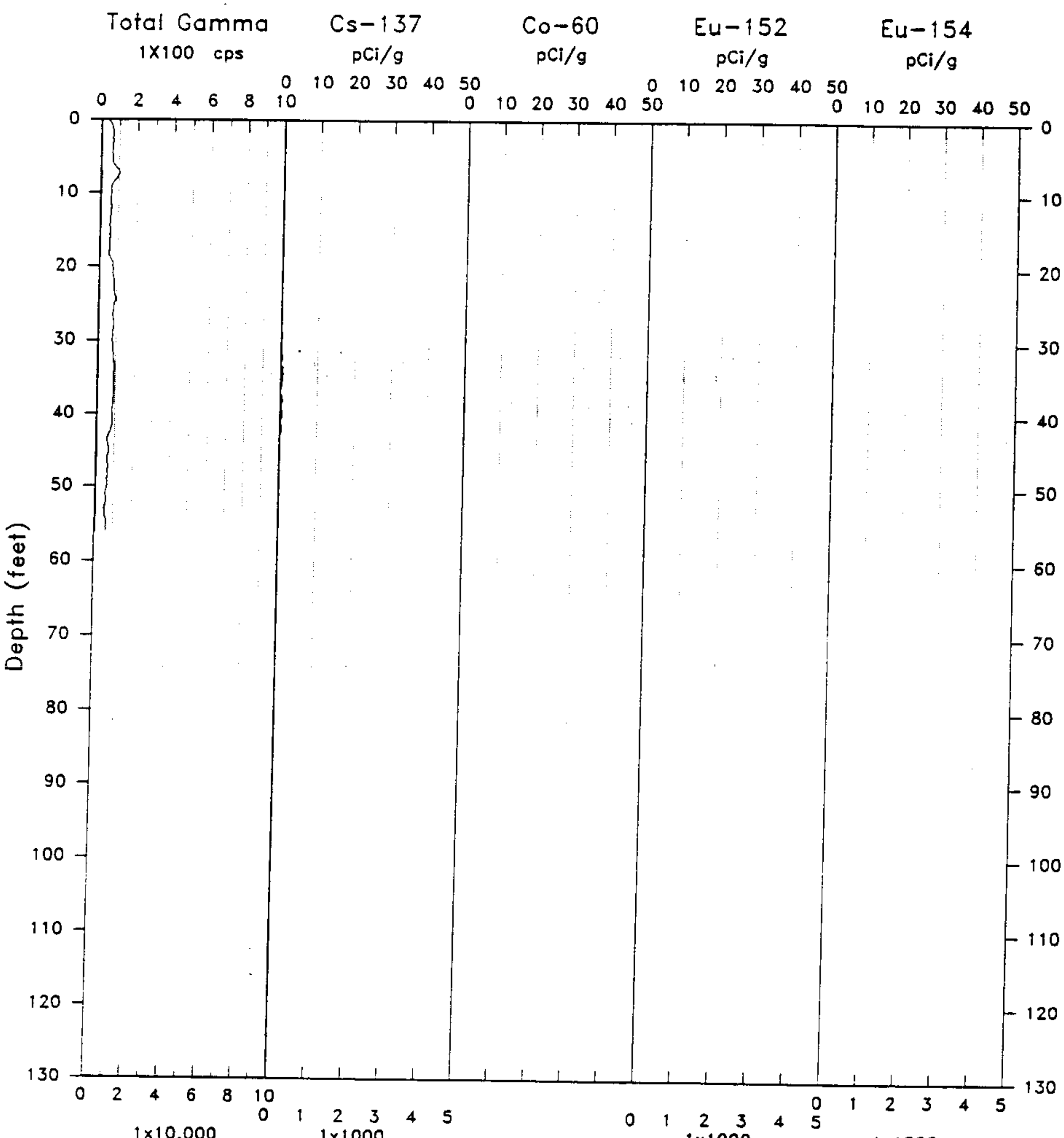
RLS Spectral Gamma-Ray Borehole Survey

Project: 100-BC-5
Borehole: 199-B3-47

Log Date: Mar 5, 92
Anal. Date: Apr 6, 92



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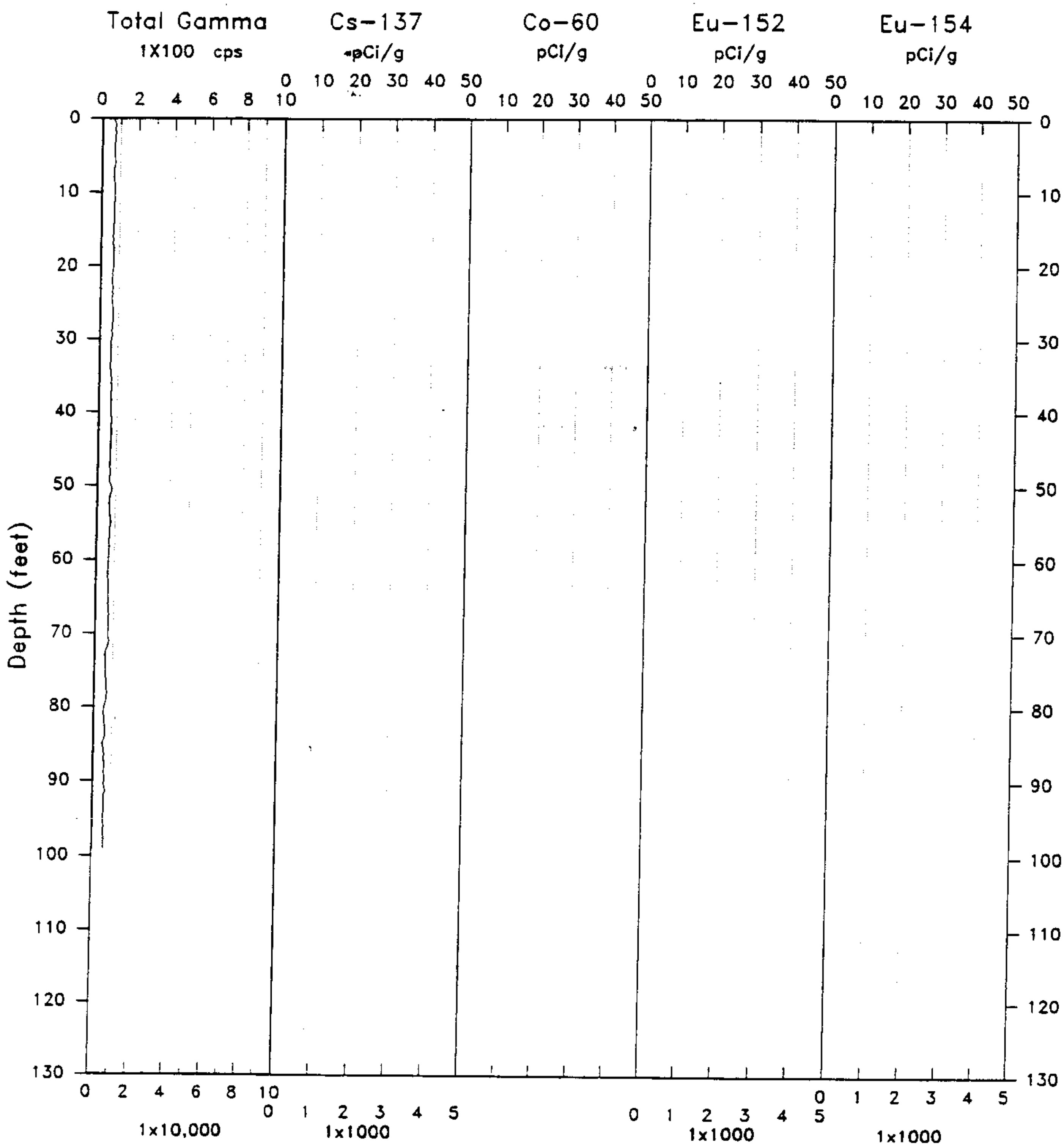
RLS Spectral Gamma-Ray Borehole Survey

Project: 100-BC-5 Log Date: July 9, 92

Borehole: 199-B4-4 Anal. Date: Aug 13, 92



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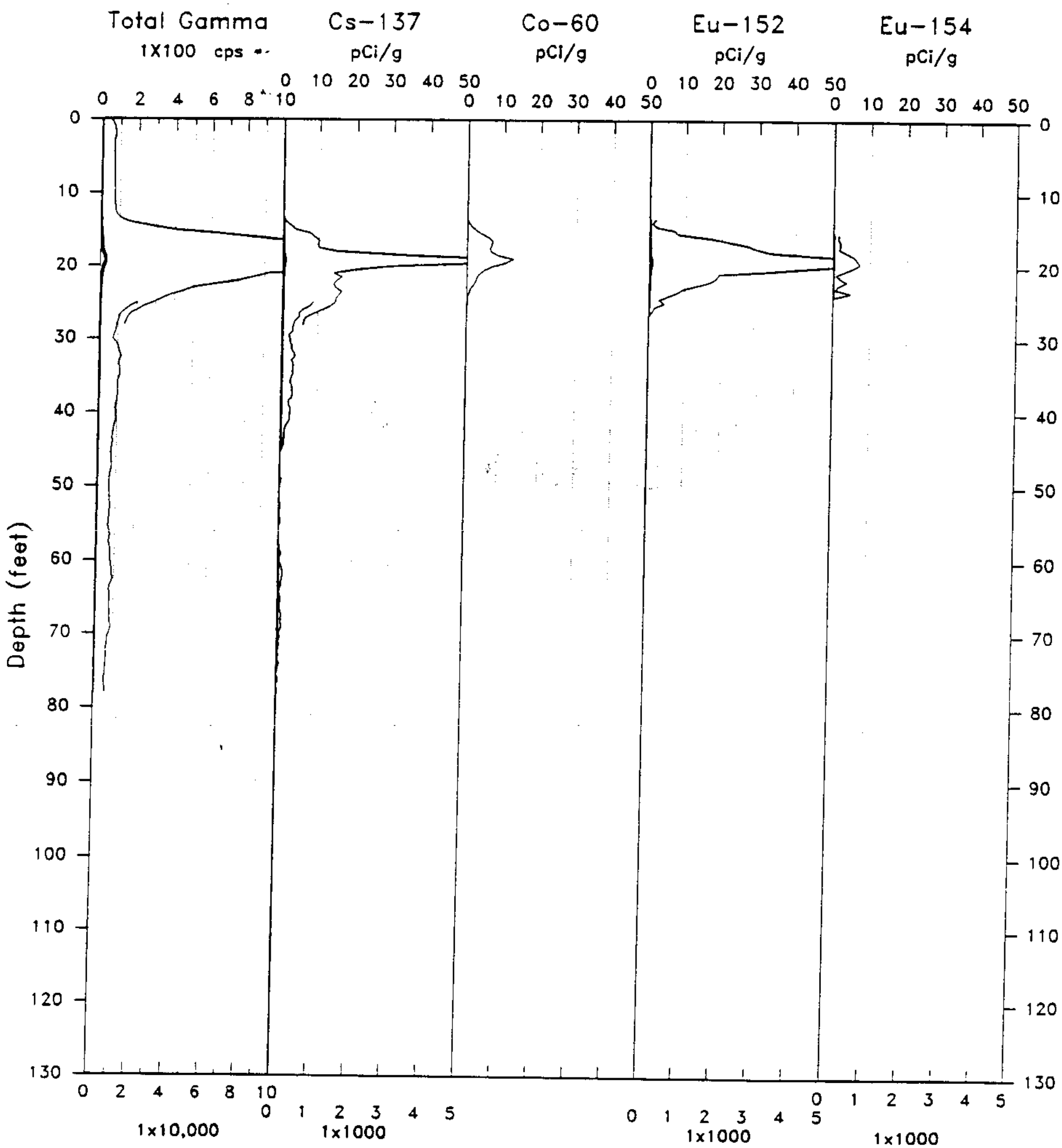
RLS Spectral Gamma-Ray Borehole Survey

Project: 100-BC-5

Borehole: 199-B4-9

Log Date: Apr 22, 92

Anal. Date: Jul 28, 92



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